#907681884
ID88069164
TN
272
.D43
1977
c.2

MILLING - COMMODITY

Alumina

* IC 8648 - 1974 - General

Ambylgonite

* IC 7084 - 1939 - South Dakota

Antimony

* IC 7194 - 1942 - Idaho

Asbestos

* IC 8068 - 1962 - Vermont
* IC 8672 - 1975 - Alaska

Copper

* IC 8656 - 1974 - Alaska, Arizona
* IC 8602 - 1973 - Alaska
IC 6479 - 1931 - Utah
IC 6619 - 1932 - British Columbia
IC 6357 - 1930 - Michigan
IC 6261 - 1930 - Mexico
IC 6364 - 1930 - Michigan
IC 6404 - 1931 - Arizona
IC 6285 - 1930 - Idaho
IC 6241 - 1930 - Arizona
IC 6394 - 1931 - New Mexico
IC 6319 - 1930 - Arizona
IC 6479 - 1931 - Utah
IC 6544 - 1931 - Cuba
IC 6573 - 1932 - Arizona
IC 6460 - 1931 - Arizona
IC 6358 - 1930 - Mexico
IC 6303 - 1930 - Arizona
IC 6467 - 1931 - Arizona
IC 6550 - 1932 - California
IC 6343 - 1930 - Arizona
IC 6489 - 1931 - Arizona
IC 6359 - 1930 - New Mexico
IC 6314 - 1930 - Idaho

Feldspar

IC 6488 - 1931 - North Carolina

Ferberite Ore

IC 6685 - 1933 - Colorado

Fluorine

* IC 8566 - 1973 - General

MILLING - COMMODITY

Fluorspar

IC 6621 - 1932 - Illinois

Galena

IC 6353 - 1930 - Oklahoma

Gold

IC 6236 - 1930 - Alaska
* IC 7058 - 1939 - Colorado
IC 6476 - 1931 - California
IC 6824 - 1935 - Arizona
IC 7012 - 1938 - California
IC 6541 - 1931 - Ontario
IC 7024 - 1938 - Idaho
IC 6739 - 1932 - Colorado
IC 6947 - 1937 - Montana
IC 7111 - 1940 - South Carolina
IC 6914 - 1936 - Alabama
IC 6408 - 1931 - South Dakota
IC 7039 - 1938 - Idaho
IC 6508 - 1931 - Ontario
IC 7123 - 1940 - Washington
IC 6476 - 1931 - California
IC 7015 - 1938 - Oregon
IC 6945 - 1937 - Arizona
IC 6433 - 1931 - Ontario
IC 6976 - 1937 - Colorado
IC 6836 - 1935 - Idaho
IC 6411 - 1931 - Montana
IC 6990 - 1938 - Colorado
IC 6975 - 1937 - Arizona
IC 6612 - 1932 - California
IC 6991 - 1938 - Arizona
IC 6900 - 1936 - California
* IC 7096 - 1940 - California
* IC 7101 - 1940 - Colorado
IC 6314 - 1930 - Idaho
IC 6320 - 1930 - Utah
IC 6555 - 1932 - California
* IC 7194 - 1942 - Idaho

Iron

* IC 8181 - 1963 - Michigan
* IC 7807 - 1957 - Missouri

Lead

* IC 8646 - 1974 - General
* IC 8028 - 1961 - Missouri
IC 6658 - 1932 - Missouri
IC 6600 - 1932 - Idaho
* IC 7875 - 1959 - Missouri

Lead

IC 6574 - 1932 - New York
IC 6359 - 1930 - New Mexico
IC 6314 - 1930 - Idaho
IC 6320 - 1930 - Utah
IC 6447 - 1931 - Montana
* IC 7428 - 1948 - Idaho
IC 6497 - 1931 - Arizona
IC 6587 - 1932 - Idaho
IC 6342 - 1930 - Oklahoma
IC 6590 - 1932 - Idaho
IC 6605 - 1932 - New Mexico
IC 6706 - 1933 - Mexico
* IC 7077 - 1939 - Arizona
IC 6430 - 1931 - Nevada

Magnetic Concentrate

IC 6624 - 1932 - New York

Manganese

* IC 8144 - 1963 - Arizona

Mercury

IC 6429 - 1931 - California
IC 7800 - 1957 - Idaho

Molybdenum

IC 6551 - 1932 - New Mexico

Nickel

* IC 8469 - 1970 - General

Pegmatites

IC 7550 - 1950 - General

Pyrite

IC 6574 - 1932 - New York

Quartz

IC 6472 - 1931 - General

Quartzite

* IC 8248 - 1965 - Pennsylvania

Rhenium

* IC 8573 - 1973 - General

Rutile (Heavy Minerals)

* IC 8540 - 1972 - General

Sand-Glass

IC 6937 - 1937 - California

Scheelite

IC 6604 - 1932 - Nevada

Silica

IC 6472 - 1931 - General

Silver

IC 7119 - 1940 - Arizona
* IC 8370 - 1968 - Colorado
* IC 7101 - 1940 - Colorado
IC 6359 - 1930 - New Mexico
IC 6314 - 1930 - Idaho
IC 6320 - 1930 - Utah
IC 6555 - 1932 - California
* IC 7194 - 1942 - Idaho

Sphalerite

IC 6353 - 1930 - Oklahoma

Talc

* IC 8142 - 1963 - Vermont

Tantalite

* IC 7084 - 1939 - South Dakota

Tin

* IC 7871 - 1958 - Alaska

Tungsten

IC 6532 - 1931 - California
IC 6280 - 1930 - Nevada
* IC 8500 - 1971 - General

Uranium

* IC 8501 - 1971 - General

Zinc

IC 6379 - 1930 - Tennessee
IC 6574 - 1932 - New York
IC 6359 - 1930 - New Mexico
IC 6314 - 1930 - Idaho
IC 6447 - 1931 - Montana
* IC 7428 - 1948 - Idaho
IC 6492 - 1931 - Utah
IC 6497 - 1931 - Arizona
IC 6587 - 1932 - Idaho
IC 6342 - 1930 - Oklahoma
IC 6590 - 1932 - Idaho
IC 6605 - 1932 - New Mexico
IC 6706 - 1933 - Mexico
* IC 7077 - 1939 - Arizona
IC 6430 - 1931 - Nevada

ALUMINA

Alumina - Lime soda

MILLING COST DATA

Year: 1973

Minerals or Ore: Alumina

State: N.A.

District or County: N.A.

Cost Estimates

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8648

Type of Ore: Clay

Type of Mill: Lime - Soda Sinter Process

Yards or Tons per Day or Shift: 1,000 tpd alumina produced

No. of Employees: N.A.

Source of Power: N.A

Distance to Smelter: N.A

How Shipped: N.A

Products: Alumina

Operators Wages: $4.50/hr

Type of Crushing & Grinding: ①

% Recovery: 79%

Water Source: N.A.

Indirect Costs per ton: $9.84

Direct Costs per ton: $66.09

Fixed Costs per ton: $11.09

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $87.02

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: Excess flue gas vented to atmosphere

Method of Rehabilitation of Tailings: Recycling

Remarks:

over ↓

Raw clay is shredded to $-\frac{1}{4}$" and then fed to a gas fired rotary kiln operated at 1300°F. Alumina in the clay may be represented by the formula: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The clay is then dehydrated before being crushed to −20 mesh.

Alumina - Lime Soda

Indirect Costs

Labor, Management, Supervision, Clerical - $1.15

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $2.78

Union Welfare, etc. N.A.

Medical and Life Insurance - $1.85 (Insurance)

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Indirect costs - $4.06

Direct Operating Costs

Production Labor - $4.01

Maintenance Labor - $2.77

Operating Supplies, Powder, Steel - $1.11

Utilities - $30.75

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment - $2.22 (Maintenance materials)

Anorthosite - $12.16

Process chemicals - $13.07

Fixed Costs

Property Taxes } $1.85 (Taxes)

Other Fixed Taxes ~~(Severance)~~ }

Depreciation - $9.24

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Alumina - Lime Soda

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital cost - $72,589,300
(including $7,882,500 working capital)

Alumina - Potassium alum

MILLING COST DATA

Year: 1973

Minerals or Ore: Alumina

State: N.A.

Cost Estimates

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8648

Type of Ore:
Clay

Type of Mill: Potassium alum process

Products: Alumina

Yards or Tons per Day or Shift:
1,000 tpd Alumina produced

Operators Wages: $4.50/hr.

No. of Employees: N.A.

Type of Crushing & Grinding: ①

Source of Power: N.A.

% Recovery: 85%

Distance to Smelter: N.A.

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: $20.90

Direct Costs per ton: $64.38

Fixed Costs per ton: $27.04

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $112.32

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: Sulfuric acid recovery plant

Method of Rehabilitation of Tailings: reagents recycled

Remarks:

over ↓

① Raw clay is shredded to -¼" and then fed to a gas fired rotary kiln operated at 1300°F, Alumina in the clay may be represented by the formula: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The clay is then dehydrated before being crushed to -20 mesh

Alumina - Potassium alum

Indirect Costs

Labor, Management, Supervision, Clerical - $2.36

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $5.55

Union Welfare, etc. N.A

Medical and Life Insurance - $4.51 (Insurance)

Royalties N.A.

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A.

Indirect Cost - $8.48

Direct Operating Costs

Production Labor - $6.82

Maintenance Labor - $6.68

Operating Supplies, Powder, Steel - $2.67

Utilities - $35.08

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment - $5.35 (Maintenance materials)

Clay - $4.98

Process Chemicals - $2.80

Fixed Costs

Property Taxes } $4.51 (Taxes)

Other Fixed Taxes ~~(Severance)~~ }

Depreciation - $22.53

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Alumina- Potassium alum

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital cost - $166,654,600
(including $8,966,100 working capital)

Alumina , HCL-IE

MILLING COST DATA

Minerals or Ore: Alumina

Year: 1973

State: N.A

District or County: N.A

Cost Estimates

Mill: Unnamed

Owner or Operator: N.A

Source of Information: I.C 8648

Type of Ore: Clay

Type of Mill: Hydrochloric Acid - Isopropyl Ether Extraction

Yards or Tons per Day or Shift: 1,000 tpd Alumina produced

Products: Alumina

No. of Employees: N.A.

Operators Wages: $4.50/hr

Source of Power: N.A

Type of Crushing & Grinding: ①

Distance to Smelter: N.A

% Recovery: N.A.

How Shipped: N.A

Water Source: N.A

Indirect Costs per ton: $14.07

Direct Costs per ton: $47.96

Fixed Costs per ton: $19.45

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $81.48

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Isopropyl Ether extracted in water column. ②

Method of Rehabilitation of Tailings: Recycling

Remarks:

over ↓

① Raw clay is shredded to -4" and then fed to a gas fired rotary kiln operated at 1300°F. Alumina in the clay may be represented by the formula: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The clay is then dehydrated before being crushed to -20 mesh.

② The ferric chloride solution is pumped to the waste decomposition section.

Alumina, HCl-IE

Indirect Costs

Labor, Management, Supervision, Clerical - $1.55

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $3.59

Union Welfare, etc. N.A.

Medical and Life Insurance - $3.24 (insurance)

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Indirect Costs - $5.69

Direct Operating Costs

Production Labor - $3.74

Maintenance Labor - $4.97

Operating Supplies, Powder, Steel - $1.99

Utilities - $24.09

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment - $3.97 (Maintenance materials)

Clay - $5.03

Process chemicals - $4.17

Fixed Costs

Property Taxes

Other Fixed Taxes (~~Severance~~) } $3.24 (Taxes

Depreciation - $16.21

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Alumina, HCl-IF

Capital Costs

- Working Capital
- Purchase Cost
- Capitalization of Exploration and Development
- Roads and other local construction
- Capitalization of Equipment
- Capitalization of Plant

Total capital costs - $120,091,800 (including $6,628,300 working capital)

Alumina, HCl

MILLING COST DATA

Minerals or Ore: Alumina

Year: 1973

State: N.A

District or County: N.A

Cost Estimates

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8648

Type of Ore:
Clay

Type of Mill: Hydrochloric Acid - Ion Exchange

Yards or Tons per Day or Shift:
1,000 tpd alumina produced

Products: Alumina

No. of Employees: N.A

Operators Wages: $4.50/hr

Source of Power: N.A

Type of Crushing & Grinding: ①

Distance to Smelter: N.A.

% Recovery: 87%

How Shipped: N.A.

Water Source: N.A

Indirect Costs per ton:	$12.86
Direct Costs per ton:	$44.21
Fixed Costs per ton:	$17.47
Capitalization Costs per ton:	N.A.
Rehabilitation Costs per ton:	N.A.
Total Milling costs per ton:	$74.54
Shipping costs per ton:	N.A.

Method of Tailings Disposal: waste pond, tailings towers

Method of Rehabilitation of Tailings: Acid recycled

Remarks:

over ↓

(1) Raw clay is shredded to -¼" and then fed to a gas fired rotary kiln operated at 1300°F. Alumina in the clay may be represented by the formula: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The clay is then dehydrated before being crushed to -20 mesh.

Alumina, HCl

Indirect Costs

Labor, Management, Supervision, Clerical - $1.43

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $3.34

Union Welfare, etc. N.A.

Medical and Life Insurance - $2.91 (Insurance)

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A

Indirect Cost - $5.18

Direct Operating Costs

Production Labor - $3.85

Maintenance Labor - $4.26

Operating Supplies, Powder, Steel - $1.71

Utilities - $21.03

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment - $3.41 (maintenance materials)

Clay - $5.02

Process Chemicals - $4.93

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $2.91 (Taxes)

Depreciation - $14.56

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Alumina, HCl

Capital Costs

- Working Capital
- Purchase Cost
- Capitalization of Exploration and Development
- Roads and other local construction
- Capitalization of Equipment
- Capitalization of Plant

Total capital cost - $108,010,600 (including $6,116,800 working capital)

Alumina, Nitric Acid

MILLING COST DATA

Minerals or Ore: Alumina

Year: 1973

State: N.A

District or County: N.A

Cost Estimates

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8648

Type of Ore:
Clay

Type of Mill: Nitric Acid - Ion Exchange

Yards or Tons per Day or Shift:
1,000 tons of alumina/day produced

No. of Employees:

Source of Power: N.A

Distance to Smelter: N.A

How Shipped: N.A

Products: Alumina

Operators Wages: $4.50/hr

Type of Crushing & Grinding:
0

% Recovery: 90%+

Water Source: N.A

Indirect Costs per ton: $12.11

Direct Costs per ton: $52.72

Fixed Costs per ton: $12.91

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $77.74

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Distillation columns (acid recovery)

Method of Rehabilitation of Tailings: Recycling

Remarks:

over ↓

① Raw clay is shredded to -¼" and then fed to a gas fired rotary kiln operated at 1300°F. Alumina in the clay may be represented by the formula: $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The clay is then dehydrated before being crushed to -20 mesh

Alumina, Nitric Acid

Indirect Costs

Labor, Management, Supervision, Clerical -$1.44

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance -$3.47

Union Welfare, etc. N.A

Medical and Life Insurance — $2.15 (insurance)

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Indirect Costs - $5.05

Direct Operating Costs

Production Labor -$5.08

Maintenance Labor -$3.39

Operating Supplies, Powder, Steel -$1.36

Utilities -$26.92

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment -$2.72 (maintenance materials)

Clay - $4.68

Process Chemicals -$8.57

Fixed Costs

Property Taxes

Other Fixed Taxes ~~(Severance)~~

} $2.15 (Taxes)

Depreciation -- $10.76

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Alumina, [illegible]

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total Capital cost - $81,972,400
(including $6,644,400 working capital)

AMBYLGONITE

Black Hills

MILLING COST DATA

Minerals or Ore: Tin (Ambylgonite, Tantalite) **Year:** 1938

State: South Dakota

District or County:

Mill: Black Hills Tin Co.

Owner or Operator: Fansteel Metallurgical Corp.

Source of Information: IC 7084

Type of Ore: Tantalite in pegmatite

Type of Mill: Concentrating table

Products: Tantalum Concentrate

Yards or Tons per Day or Shift: 32 tons/day (milled)

Operators Wages: $2-$6/shift

No. of Employees: 5

Type of Crushing & Grinding: ①

Source of Power: Diesel power unit on site

% Recovery: N.A

Distance to Smelter: N.A

Water Source: Pumped from sump in Mallory Gulch (¾ mi)

How Shipped: N.A

Indirect Costs per ton: $0.185

Direct Costs per ton: $0.792

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $0.977

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: 3 brush dams and a large earth dam

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① Gyratory crusher set at 2"

↓

Cone crusher set at 1/4"

↓

rolls

Black Hills

Indirect Costs

Labor, Management, Supervision, Clerical } $0.185
Mine Office, Warehouse }
Payroll Overhead - Social Security, Insurance N.A.
Union Welfare, etc. N.A.
Medical and Life Insurance N.A.
Royalties N.A.
Pension Funds N.A.
Severance Tax N.A.
Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $0.417
Maintenance Labor - $0.100
Operating Supplies, Powder, Steel - $0.068
Utilities - $0.207
Transportation Mine to Mill N.A.
Freight, Supplies Delivered N. A.
Future Development Costs N.A.
Maintenance and Service of Equipment N.A

Fixed Costs N.A.

Property Taxes
Other Fixed Taxes (Severance)
Depreciation
Interest
General Management
Selling, Marketing

Black Hills

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

ANTIMONY

Yellow Pine

MILLING COST DATA

Minerals or Ore: Gold, Silver, Antimony **Year:** 1940

State: Idaho

District or County: Valley County

Mill: Yellow Pine concentrator

Owner or Operator: Bradley Mining Co.

Source of Information: IC 7194

Type of Ore: Pyrite and arsenopyrite disseminated through more or less altered grandiorite-aplite country rock. Stibnite ①

Type of Mill: Flotation

Products: Gold, silver concentrate

Yards or Tons per Day or Shift: 14,000 tons/month

Operators Wages: N.A.

No. of Employees: N.A

Type of Crushing & Grinding: ②

Source of Power: Hydroelectric plants, diesel sets.

% Recovery: mill recovery: 70%, economic recovery: 61%

Distance to Smelter: approximately 375 miles

Water Source: ③

How Shipped: Truck then railroad

Indirect Costs per ton: . . . . N.A.

Direct Costs per ton: $0.7850

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $0.7858

Shipping costs per ton: . . . . $9 - $10

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A.

Remarks: over ↓

occurs on the west side of the ore zone disseminated through the ore and in high-grade stringers.

② 24" x36" Blake-type jaw crusher
↓
No. 5 Gates gyratory crusher
↓
3-foot Symons cone crusher
↓
8'x3' and 8'x4' Hardinge ball mill

③ Mill water is from a dam on the South Fork of Meadow Creek. Water for power comes from Meadow creek and its South Fork and from the East Fork of the South Fork of the Salmon River.

Yellow Pine

Indirect Costs N.A

Labor, Management, Supervision, Clerical

Mine Office, Warehouse

Payroll Overhead - Social Security, Insurance

Union Welfare, etc.

Medical and Life Insurance

Royalties

Pension Funds

Severance Tax

Rehabilitation Costs

Direct Operating Costs

Production Labor } $0.2740 (labor)

Maintenance Labor }

Operating Supplies, Powder, Steel - $0.2895

Utilities

Transportation Mine to Mill

Freight, Supplies Delivered

Future Development Costs

Maintenance and Service of Equipment

Miscellaneous - $0.2215

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Yellow Pine

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

ASBESTOS

MILLING COST DATA

Year: 1958

Minerals or Ore: Asbestos

State: Vermont

District or County: Lamoille and Orleans Counties

Mill: Vermont Asbestos Mines

Owner or Operator: The Ruberoid Co.

Source of Information: IC 8068

Type of Ore:
Asbestos in serpentine host rock

Type of Mill: Aspirator and shaking table

Yards or Tons per Day or Shift:
3,500 tons of ore/day

No. of Employees: 104

Source of Power:

Distance to Smelter: N.A.

How Shipped: Trucks

Products: 35-40 grades of asbestos

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: N.A.

Water Source: N.A.

Indirect Costs per ton: . . . .

Direct Costs per ton: . . . .

Fixed Costs per ton: . . . .

Capitalization Costs per ton: . . . .

Rehabilitation Costs per ton: . . . .

Total Milling costs per ton: . . . .

Shipping costs per ton: . . . .

see attached sheets, units inconsistent.

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① 48" by 60" jaw crusher ⟶ 5½' cone crusher ┐

3' short head cone crusher ←┘

Indirect Costs N.A.

Labor, Management, Supervision, Clerical

Mine Office, Warehouse

Payroll Overhead - Social Security, Insurance

Union Welfare, etc.

Medical and Life Insurance

Royalties

Pension Funds

Severance Tax

Rehabilitation Costs

Direct Operating Costs

Production Labor }
Maintenance Labor } 0.062 man hrs/ton

Operating Supplies, Powder, Steel — $0.046 /ton

Utilities – 7.41 horsepower-hrs /ton

Transportation Mine to Mill

Freight, Supplies Delivered

Future Development Costs

Maintenance and Service of Equipment

fuel oil - 0.973 gallons /ton

Transportation to warhouse - $0.089/ton

Fixed Costs N.A.

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Alaska Asbestos

MILLING COST DATA

Year: 1975

Minerals or Ore: Asbestos

State: Alaska

District or County: Fairbanks - Ft. Yukon

Mill: None

Owner or Operator: None

Source of Information: IC 8672

Type of Ore:
The asbestos occurs in large joint blocks of dark gray, black and dark-greenish and brownish black serpentine ①

Type of Mill: Fiberizing and screening

Yards or Tons per Day or Shift: 4600 tons / day

No. of Employees:

Source of Power: N.A.

Distance to Smelter: N.A

How Shipped: N.A.

Products: 4 grades of asbestos fiber

Operators Wages: $6.28 / hr

Type of Crushing & Grinding: ②

% Recovery: N.A.

Water Source: N.A

Indirect Costs per ton: $1.90

Direct Costs per ton: $3.74

Fixed Costs per ton: $0.38

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $6.02

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: Tailings pile

Method of Rehabilitation of Tailings: N.A.

Remarks:
Estimate of cost to mine and process asbestos.

① (antigorite). The outcrop is about 500 ft long and 200 ft. wide.

② 48" x 60" jaw crusher
↓
5½' standard head cone crusher
↓
48" x 50" impact crusher

Alaska Asbestos

Indirect Costs

Labor, Management, Supervision, Clerical - $0.63

Mine Office, Warehouse - $0.22

Payroll Overhead - Social Security, Insurance - $0.45

Union Welfare, etc. - $0.22

Medical and Life Insurance - $0.38 (taxes and insurance)

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $0.72

Maintenance Labor - $0.43

Operating Supplies, Powder, Steel - $1.19

Utilities - $0.86

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment - $0.54

Fixed Costs

Property Taxes - $0.38

Other Fixed Taxes (Severance) N.A

Depreciation N.A

Interest N.A

General Management N.A

Selling, Marketing N.A

Alaska Asbestos

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

COPPER

Unnamed
(Cu 40,000 tpd)
(Arizona)

MILLING COST DATA

Year: 1974

Minerals or Ore: Copper

State: Arizona

District or County: Pinal County

Mill: Unnamed 100,000 tpd hypothetical open pit

Owner or Operator: N.A.

Source of Information: IC 8656

Type of Ore: Copper porphyry: 0.50% copper with associated gold, silver and molybdenum

Type of Mill: Flotation

Yards or Tons per Day or Shift: 40,000 tpd

No. of Employees: 728 (mine & mill)

Source of Power: Electric Utility

Distance to Smelter: Approximately 400 miles

How Shipped: Railroad

Products: copper concentrate
molybdenum concentrate

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: N.A

Water Source: N.A

Indirect Costs per ton: $0.21

Direct Costs per ton: $0.82

Fixed Costs per ton: $0.55

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $1.58

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

see attached sheet

over↓

① Gyratory Crusher
↓
Cone Crusher
↓
Rod Mill
↓
Ball Mill
↓
Regrind Ball Mill (if necessary)

(Cu 40,000 tpd)
(Arizona)

Indirect Costs

Labor, Management, Supervision, Clerical — $0.08
Mine Office, Warehouse — $0.05 (General overhead)
Payroll Overhead - Social Security, Insurance — $0.08
Union Welfare, etc. N.A
Medical and Life Insurance N.A
Royalties N.A
Pension Funds N.A.
Severance Tax, N.A
Rehabilitation Costs N.A

Direct Operating Costs

Production Labor — $0.14
Maintenance Labor — $0.10
Operating Supplies, Powder, Steel — $0.38
Utilities — $0.20
Transportation Mine to Mill N.A
Freight, Supplies Delivered, N.A.
Future Development Costs N.A.
Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes — $0.12
Other Fixed Taxes (Severance) — $0.12 (Taxes and insurance)
Depreciation — $0.31
Interest N.A
General Management N.A.
Selling, Marketing N.A.

Capital Costs N/A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Estimated annual cost(arizona dollars

Item	Mine		Mill		Support facilities		Total	
	Annual cost	cost per ton	Annual cost	Cost per ton	Annual cost	Cost per ton	Annual cost	Cost per ton
irect cost:								
Production:								
Labor	1,413,700	0.10	1,952,500	0.14	274,600	0.02	3,640,800	0.26
Supervision	212,100	0.01	292,900	0.02	41,200	Nil	546,200	0.03
Subtotal	1,625,800	0.11	2,245,400	0.16	315,800	0.02	4,187,000	0.29
aintenance:								
Labor	1,053,200	0.07	1,460,700	0.10	101,900	0.01	2,615,800	0.18
Supervision	210,600	0.01	292,100	0.02	20,400	Nil	523,100	0.03
Maintenance supplies and parts	2,840,100	0.20	1,267,200	0.09	80,100	0.01	4,187,400	0.30
Subtotal	4,103,900	0.28	3,020,000	0.21	202,400	0.02	7,326,300	0.51
perating supplies	2,729,900	0.19	4,005,500	0.28	-	-	6,735,400	0.47
ower	218,500	0.02	2,527,100	0.18	-	-	2,745,600	0.20
ater	2,600	Nil	241,600	0.02	-	-	244,200	0.02
atural gas	5,300	Nil	8,500	Nil	-	-	13,800	Nil
ayroll overhead - 25 percent of payroll	722,400	0.05	999,600	0.07	109,500	0.01	1,831,500	0.13
Total direct cost	9,408,400	0.65	13,047,700	0.92	627,700	0.05	23,083,800	1.62
ndirect cost:								
Administrative, technical and clerical labor	907,900	0.06	613,100	0.04	169,000	0.01	1,690,000	0.11
Payroll overhead - 25 percent of payroll	227,000	0.02	153,300	0.01	42,200	Nil	422,500	0.03
Facilities maintenance and supplies - 0.25 percent of plant cost	66,100	Nil	208,600	0.01	46,400	Nil	321,100	0.01
General overhead includes head office charges and research - 5 percent of direct costs	470,400	0.03	652,400	0.05	31,400	Nil	1,154,200	0.08
Total indirect cost	1,671,400	0.11	1,627,400	0.11	289,000	0.01	3,587,800	0.23
ixed cost:								
Taxes and insurance - 2 percent of plant cost	529,100	0.04	1,668,400	0.12	371,200	0.03	2,568,700	0.19
Depreciation	2,659,700	0.19	4,454,600	0.31	981,500	0.07	8,095,800	0.57
Property taxes - 2 percent of plant cost	529,100	0.04	1,668,400	0.12	371,200	0.03	2,568,700	0.19
Total fixed cost	3,717,900	0.27	7,791,400	0.55	1,723,900	0.13	13,233,200	0.95
Total operating cost	14,797,700	1.03	22,466,500	1.58	2,640,600	0.19	39,904,800	2.80

Unnamed
(Cu 40,000 tpd)
(Alaska)

MILLING COST DATA

Year: 1974

Minerals or Ore: Copper

State: Alaska

District or County: South central, Lake Clark area

Mill: Unnamed

109000 tpd hypothetical open pit

Owner or Operator: N.A.

Source of Information: IC 8656

Type of Ore: porphyry 0.50% copper with associated gold, silver and molybdenum.

Type of Mill: Flotation

Yards or Tons per Day or Shift: 40,000 tpd.

No. of Employees: 333 (mine & mill)

Source of Power: 2-25 Mw gas turbines

Distance to Shelter: N.A.

How Shipped: Railroad, Barge

Products: copper concentrate
molybdenum concentrate

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: N.A

Water Source: N.A

Indirect Costs per ton: . . . . #0.34

Direct Costs per ton: . . . . #1.48

Fixed Costs per ton: . . . . #1.11

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . #2.93

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal:

Method of Rehabilitation of Tailings:

Remarks: see attached sheet

over↓

(1) Gyratory crusher

↓

Cone Crusher

↓

Rod Mill

↓

Ball Mill

↓

Regrind Ball Mill (if necessary)

Unnamed
(Cu 40,000 tpd)
(Alaska)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.13

Mine Office, Warehouse - $0.08 (General overhead)

Payroll Overhead - Social Security, Insurance - $0.13

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $0.22

Maintenance Labor - $0.16

Operating Supplies, Powder, Steel - $0.58

Utilities - $0.44

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Taxable subsidies - $0.08

Fixed Costs

Property Taxes - $0.24

Other Fixed Taxes (Severance) $0.24 (taxes and insurance)

Depreciation - $0.63

Interest N.A.

General Management N.A.

Selling, Marketing N.A

Unnamed
(Cu 40,000 tpd)
(Alaska)

Capital Costs N/A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TABLE 4. - Estimated annual cost in Alaska, dollars

Item	Mine		Mill		Support facilities		Total	
	Annual cost	Cost per ton	Annual cost	Cost per ton	Annual cost	Cost per ton	Annual cost	Cost per ton
Direct cost:								
Production:								
Labor	2,246,200	0.16	3,106,300	0.22	553,300	0.04	5,905,800	0.42
Supervision	336,900	0.02	465,900	0.03	83,000	0.01	885,800	0.06
Subtotal	2,583,100	0.18	3,572,200	0.25	636,300	0.05	6,791,600	0.48
Maintenance:								
Labor	2,255,800	0.16	2,345,500	0.16	390,000	0.03	4,991,300	0.35
Supervision	451,200	0.03	469,100	0.03	78,000	0.01	998,300	0.07
Maintenance supplies and parts	3,248,000	0.23	1,926,300	0.13	727,900	0.05	5,902,200	0.41
Subtotal	5,955,000	0.42	4,740,900	0.32	1,195,900	0.09	11,891,800	0.83
Operating supplies	3,372,400	0.24	6,047,600	0.42	-	-	9,420,000	0.66
Power	520,200	0.04	5,502,000	0.39	63,100	Nil	6,085,300	0.43
Water	5,100	Nil	483,200	0.03	5,100	Nil	493,400	0.03
Natural gas	35,100	Nil	275,900	0.02	11,100	Nil	322,100	0.02
Payroll overhead - 25 percent of payroll	1,322,500	0.09	1,596,700	0.11	276,100	0.02	3,195,300	0.22
Taxable subsidies - 15 percent of payroll	793,500	0.06	958,000	0.07	165,600	0.01	1,917,100	0.14
Total direct cost	14,586,900	1.03	23,176,500	1.61	2,353,200	0.17	40,116,600	2.81
Indirect cost:								
Administrative technical and clerical labor	1,375,500	0.10	928,500	0.07	576,000	0.04	2,880,000	0.21
Payroll overhead - 25 percent of payroll	343,900	0.02	232,100	0.02	144,000	0.01	720,000	0.05
Taxable subsidies - 15 percent of payroll	206,300	0.01	139,300	0.01	86,400	0.01	432,000	0.03
Facilities maintenance and supplies - 0.25 percent of plant cost	99,800	0.01	424,300	0.03	238,400	0.02	762,500	0.06
General overhead including head office charges, exploration and research - 5 percent of direct costs	729,300	0.05	1,158,800	0.08	117,700	0.01	2,005,800	0.14
Total indirect cost	2,754,800	0.19	2,883,000	0.21	1,162,500	0.09	6,800,300	0.49
Fixed cost:								
Taxes and insurance - 2 percent of plant cost	798,200	0.06	3,394,700	0.24	1,907,000	0.13	6,099,900	0.43
Depreciation	3,544,400	0.25	8,996,700	0.63	5,095,800	0.36	17,636,900	1.24
Property taxes - 2 percent of plant cost	798,200	0.06	3,394,700	0.24	1,907,000	0.13	6,099,900	0.43
Total fixed cost	5,140,800	0.37	15,786,100	1.11	8,909,800	0.62	29,836,700	2.10
Total operating cost	22,482,500	1.59	41,845,600	2.93	12,425,500	0.88	76,753,600	5.40

Kennecott

MILLING COST DATA

Minerals or Ore: Copper

Year: 1972

State: Alaska

District or County: Near McCarthy, Alaska

Mill: Kennecott Mill (unnamed)

Owner or Operator: Kennecott Copper Corp.

Source of Information: IC 8602 Mineral Feasibility Study

Type of Ore: High grade copper replacements in limestone and dolomite. the predominant mineral was chalcocite with some malachite and azurite.

Type of Mill: Sulfide flotation, then oxide flotation

Yards or Tons per Day or Shift:
1,000 tpd processed, 198 tpd concentrate.

Products: Copper

No. of Employees: 54

Operators Wages:
$40.00 - $49.92/shift (avg)

Source of Power: N.A.

Type of Crushing & Grinding:
Ⓓ

Distance to Smelter: 1750 miles

% Recovery: 96%

How Shipped:
Truck, Barge

Water Source:
½ from thickener.

Indirect Costs per ton: $2.62

Direct Costs per ton: $3.06

Fixed Costs per ton: $4.77

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $10.45

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A

Remarks:
Study concerns re-opening mill, was closed in 1938

over ↓

① Jaw Crusher

↓

Cone Crusher

↓

Rod Mill

↓

Ball Mill

Kennecott

Indirect Costs

Labor, Management, Supervision, Clerical - $0.58

Mine Office, Warehouse - $0.47

Payroll Overhead - Social Security, Insurance - #0.86

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Indirect Costs - #0.71

Direct Operating Costs

Production Labor - $0.67

Maintenance Labor - $0.73

Operating Supplies, Powder, Steel - #1.08

Utilities - #0.58

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes - #1.04

Other Fixed Taxes ~~(Severance)~~ $1.04 (Taxes and insurance)

Depreciation - #2.69

Interest N.A.

General Management N.A

Selling, Marketing N.A.

Kennecott

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirement (mine and mill) - $57,595,500
(including #2,051,400 working capital)

FLUORINE

Unnamed
(CaF_2, 100,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

District or County: N.A.

Economic Availability Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8566

Type of Ore: waste fluosilicic acid (H_2SiF_6) which is a byproduct in the manufacture of wet process phosphoric acid and superphosphate fertilizer

Type of Mill: Chemical process D

Products: Calcium Fluoride (CaF_2)
Silica (SiO_2)

Yards or Tons per Day or Shift: 100,000 tpy input

Operators Wages: \$3.75 - \$3.80/hr

No. of Employees: N.A.

Type of Crushing & Grinding: N.A.

Source of Power: N.A

% Recovery: N.A.

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton: \$9.16

Direct Costs per ton: \$31.63

Fixed Costs per ton: \$14.08

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: \$54.87

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A.

Remarks: over ↓

) The reactions for the operations are

$$H_2SiF_{6(liq)} + 6NH_{3(g)} + 2H_2O_{(liq)} \xrightarrow{pH\ 9} 6NH_4F_{(liq)} + SiO_{2(sol)}$$

$$6NH_4F_{(liq)} + 3Ca(OH)_{2\ (liq)} + 3H_2O_{(liq)} \longrightarrow 3CaF_{2\ (sol)} + 9H_2O_{(liq)} + 6NH_{3(g)}$$

Unnamed
(CaF_2, 100,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - $1.54

Mine Office, Warehouse - $4.82 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $2.80

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $8.03

Maintenance Labor - $1.63

Operating Supplies, Powder, Steel - $0.85

Utilities - $2.31

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A.

Production chemicals - $18.81

Fixed Costs

Property Taxes N.A.

Other Fixed Taxes (Severance) - $2.49 (taxes and insurance)

Depreciation - $11.59

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Unnamed
(CaF_2, 100,000 tpy)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirement - $3,370,900
(including $245,200 working capital)

Unnamed
(CaF_2, 50,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

District or County: N.A.

Economic Availability Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8566

Type of Ore: Waste fluosilicic acid (H_2SiF_6) which is a byproduct in the manufacture of wet process phosphoric acid and superphosphate fertilizer

Type of Mill: Chemical Process ①

Products: Calcium Chloride ($CaCl_2$)
Silica (SiO_2)

Yards or Tons per Day or Shift: 50,000 tpy input

Operators Wages: $3.75-$3.80/hr

No. of Employees: N.A.

Type of Crushing & Grinding: N.A.

Source of Power: N.A

% Recovery: N.A.

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton: $14.88

Direct Costs per ton: $39.05

Fixed Costs per ton: $17.98

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $71.91

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

) The reactions for the operations are

$$H_2SiF_{6(liq)} + 6NH_{3(g)} + 2H_2O_{(liq)} \xrightarrow{pH\ 9} 6NH_4F_{(liq)} + SiO_{2(sol)}$$

$$6NH_4F_{(liq)} + 3Ca(OH)_{2(liq)} + 3H_2O_{(liq)} \longrightarrow 3CaF_{2(sol)} + 9H_2O_{(liq)} + 6NH_{3(g)}$$

Unnamed
(CaF_2, 59000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - $2.49

Mine Office, Warehouse - $7.81 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $4.58

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $13.39

Maintenance Labor - $2.44

Operating Supplies, Powder, Steel - $1.18

Utilities - $2.98

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A.

Production chemicals - $19.06

Fixed Costs

Property Taxes N.A.

Other Fixed Taxes (Severance) - $3.18 (taxes and insurance)

Depreciation - $14.80

Interest N.A.

General Management N.A.

Selling, Marketing N.A

Unnamed
(CaF_2, 50,000 tpy)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - $2,166,000 (including # 169,100 working capital)

Unnamed
(CaF_2, 25,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

District or County: N.A

Economic Availability Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8566

Type of Ore:
Waste Fluosilicic acid (H_2SiF_6) which is a byproduct in the manufacture of wet process phosphoric acid and superphosphate fertilizer

Type of Mill: Chemical process ①

Products: Calcium Fluoride and Silica (SiO_2)

Yards or Tons per Day or Shift: 25000 tpy input

Operators Wages: $3.75-$3.80/hr

No. of Employees: N.A

Type of Crushing & Grinding: N.A.

Source of Power: N.A

% Recovery: N.A

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton:	$23.04
Direct Costs per ton:	$50.41
Fixed Costs per ton:	$23.55
Capitalization Costs per ton:	N.A
Rehabilitation Costs per ton:	N.A
Total Milling costs per ton:	$97.00
Shipping costs per ton:	N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

Over ↓

The reactions for the operations are:

$H_2SiF_{6(aq)} + 6NH_{3(g)} + 2H_2O_{(liq)} \xrightarrow{pH\ 9} 6NH_4F_{(liq)} + SiO_{2(sol.)}$

$NH_4F_{(aq)} + 3Ca(OH)_{2(liq)} + 3H_2O_{(liq)} \dashrightarrow 3CaF_{2(sol)} - 9H_2O_{(liq)} + 6NH_{3(g)}$

Unnamed
(CaF_2, 25,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - #3.86
Mine Office, Warehouse - #12.04 (Administration and general overhead)
Payroll Overhead - Social Security, Insurance - #7.14
Union Welfare, etc. N.A
Medical and Life Insurance N.A
Royalties N.A
Pension Funds N.A
Severance Tax N.A
Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - #21.41
Maintenance Labor - #3.26
Operating Supplies, Powder, Steel - #1.56
Utilities - #5.31
Transportation Mine to Mill N.A
Freight, Supplies Delivered N.A
Future Development Costs N.A
Maintenance and Service of Equipment N.A
Production chemicals - #19.87

Fixed Costs

Property Taxes N.A
Other Fixed Taxes (Severance) - #3.57 (taxes and insurance)
Depreciation - #19.98
Interest N.A
General Management N.A
Selling, Marketing N.A

Unnamed
(CaF_2, 25,000

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - #1,444,800
(including #119,300 working capital)

Unnamed
(CaF_2, 10,000tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

District or County: N.A Economic Availability Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8566

Type of Ore: Waste fluosilicic acid (H_2SiF_6) which is a byproduct in the manufacture of wet process phosphoric acid and superphosphate fertilizer

Type of Mill: Chemical process①

Yards or Tons per Day or Shift: 10,000 tpy input

No. of Employees: N.A.

Source of Power: N.A

Distance to Smelter: N.A

How Shipped: N.A.

Products: Calcium Fluoride (CaF_2)
Silica (SiO_2)

Operators Wages: \$3.75-\$3.80/hr

Type of Crushing & Grinding: N.A.

% Recovery: N.A

Water Source: N.A

Indirect Costs per ton:	\$57.31
Direct Costs per ton:	\$89.12
Fixed Costs per ton:	\$37.76
Capitalization Costs per ton:	N.A
Rehabilitation Costs per ton:	N.A
Total Milling costs per ton:	\$184.19
Shipping costs per ton:	N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over
V

① The reactions for the operations are:

$$H_2SiF_{6(liq)} + 6NH_{3(g)} + 2H_2O_{(liq)} \xrightarrow{pH\ 9} 6NH_4F_{(liq)} + SiO_{2(sol.)}$$

$$NH_4F_{(liq)} + 3Ca(OH)_{2(liq)} + 3H_2O_{(liq)} \dashrightarrow 3CaF_{2(sol.)} + 9H_2O_{(liq)} + 6NH_{3(g)}$$

Unnamed
(CaF_2, 10,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - $9.65

Mine Office, Warehouse - $29.82 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $17.84

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $53.52

Maintenance Labor - $8.15

Operating Supplies, Powder, Steel - $3.22

Utilities - $5.25

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Production chemicals - $18.98

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) - $6.69 (taxes and insurance)

Depreciation - $31.08

Interest N.A

General Management N.A.

Selling, Marketing N.A.

Unnamed
(CaF_2, 10,000tpy)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - $938,500
(including $100,500 working capital)

Unnamed
(AlF_3, 50,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

Economic Availability Study

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8566

Type of Ore: Waste fluosilicic acid (H_2SiF_6) generated in processing phosphate rock to produce fertilizers and other phosphate

Type of Mill: Chemical process ①

Products: Aluminum Fluoride (AlF_3)

Yards or Tons per Day or Shift: 50,000 tpy input

Operators Wages: $3.00-$3.25/hr

No. of Employees: 29

Type of Crushing & Grinding: N.A.

Source of Power: N.A.

% Recovery: ②

Distance to Smelter: N.A.

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: $10.71

Direct Costs per ton: $187.35

Fixed Costs per ton: $13.52

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $211.58

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Exhaust gases to air scrubbers

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① The overall chemical reaction is:

$2Al(OH)_3 + H_2SiF_6 = 2AlF_3 + SiO_2 + 4H_2O$

② from phosphoric acid or fertilizer production - 37% overall
from normal superphosphate production - 20% overall
from triple superphosphate production - 4% overall
from nitraphosphate production - 31% overall

Unnamed
(F, 50,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - $1.30

Mine Office, Warehouse - $7.40 (Admin and general over-head)

Payroll Overhead - Social Security, Insurance - $2.01

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $4.55

Maintenance Labor - $1.52

Operating Supplies, Powder, Steel $11.13

Utilities - $12.01

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Production chemicals - $158.14

Fixed Costs

Property Taxes N.A.

Other Fixed Taxes (Severance) - $3.65 (taxes and insurance)

Depreciation - $9.87 (Depreciation and deferred expenses)

Interest N.A.

General Management N.A

Selling, Marketing N.A

Unnamed
(F, 50,000 tpy)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - $10,365,900
(including $1,688,200 working capital)

Unnamed
(AlF_3, 10,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

Economic Availability Study

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8566

Type of Ore: Waste (fluosilicic acid H_2SiF_6) generated in processing phosphate rock to produce fertilizers and other phosphate products

Type of Mill: chemical process①

Products: Aluminum fluoride (AlF_3)

Yards or Tons per Day or Shift: 10,000 tpy. input

Operators Wages: $2.00-$3.00/hr

No. of Employees: 17

Type of Crushing & Grinding: N.A

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton: $30.91

Direct Costs per ton: $222.26

Fixed Costs per ton: $24.90

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $278.07

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Exhaust gases to air scrubbers

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① The overall chemical reaction is:

$$2Al(OH)_3 + H_2SiF_6 = 2AlF_3 + SiO_2 + 4H_2O$$

② from phosphoric acid or fertilizer production - 37% overall
from normal superphosphate production - 20% overall
from triple superphosphate production - .4% overall
from nitraphosphate production - 31% overall

Unnamed
(F, 10,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - $6.49

Mine Office, Warehouse - $17.99 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $6.43

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $13.72

Maintenance Labor - $3.81

Operating Supplies, Powder, Steel - $20.96

Utilities - $12.03

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Production chemicals $171.74

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) - $6.73 (taxes and insurance)

Depreciation - $18.17 (Depreciation and deferred expense)

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Unnamed
(F, 10,000 tpy

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - $3,472,400
(including $468,500 working capital)

unnamed
(AlF_3, 100,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

Economic Availability Study

District or County: N.A

Mill: Unnamed

Owner or Operator: N.A

Source of Information: I C 8566

Type of Ore: Waste fluosilicic acid (H_2SiF_6) generated in processing phosphate rock to produce fertilizers and other phosphate

Type of Mill: Chemical process ①

Products: Aluminum Fluoride (AlF_3)

Yards or Tons per Day or Shift: 100,000 Tpy input

Operators Wages: \$3.00-\$3.25/hr

No. of Employees: 39

Type of Crushing & Grinding: N.A

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A.

Water Source: N.A.

How Shipped: N.A

Indirect Costs per ton:	\$8.00
Direct Costs per ton:	\$172.04
Fixed Costs per ton:	\$12.57
Capitalization Costs per ton:	N.A
Rehabilitation Costs per ton:	N.A.
Total Milling costs per ton:	\$192.61
Shipping costs per ton:	N.A.

Method of Tailings Disposal: Exhaust gases to air scrubbers

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① The overall chemical reaction is:

$$2Al(OH)_3 + H_2SiF_6 == 2AlF_3 + SiO_2 + 4H_2O$$

② from phosphoric acid or fertilizer production - 37% overall
from normal superphosphate production - 20% overall
from triple superphosphate production - 4% overall
from nitraphosphate production - 31% overall

Unnamed
(F, 100,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - #0.65

Mine Office, Warehouse - #6.01 (Administration and general expense)

Payroll Overhead - Social Security, Insurance - #1.34

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $3.28

Maintenance Labor - $0.76

Operating Supplies, Powder, Steel - #10.34

Utilities - $12.01

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Production chemicals - #145.65

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) - #3.40 (taxes and insurance)

Depreciation - #9.17 (depreciation and deferred expenses)

Interest V.A.

General Management N.A

Selling, Marketing N.A.

Unnamed
(F, 100,000 t/yr)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - $18,340,200
(including $3,042,700 working capital)

Unnamed
(CaF_2, 5,000 Tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

District or County: N.A

Economic Availability Stud

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8566

Type of Ore: Waste fluosilicic acid (H_2SiF_6) which is a byproduct in the manufacture of wet process phosphoric acid and superphosphate fertilizer

Type of Mill: Chemical process①

Products: Calcium Fluoride (CaF_2)
Silica (SiO_2)

Yards or Tons per Day or Shift: 5,000 Tpy input

Operators Wages: $3.75 - $3.8 /hr

No. of Employees: N.A.

Type of Crushing & Grinding: N.A.

Source of Power: N.A

% Recovery: N.A.

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: $114.35

Direct Costs per ton: $153.38

Fixed Costs per ton: $48.66

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $316.39

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① The reactions for the operation are:

$$H_2SiF_{6\,(liq)} + 6NH_{3\,(g)} + 2H_2O_{(liq)} \xrightarrow{pH\ 9} 6NH_4F_{(liq)} + SiO_{2\,(sol)}$$

$$6NH_4F_{(liq)} + 3Ca(OH)_{2\,(liq)} + 3H_2O_{(liq)} \dashrightarrow 3CaF_{2\,(sol)} + 9H_2O_{(liq)} + 6NH_{3\,(g)}$$

Unnamed
(CaF_2, 5,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical – $19.32

Mine Office, Warehouse - $5233 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $35.70

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $107.09

Maintenance Labor - $16.30

Operating Supplies, Powder, Steel - $5.54

Utilities - $5.30

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Production chemicals - $19.15

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) - $7.50 (Taxes and [illegible]

Depreciation - $41.16

Interest N.A

General Management N.A.

Selling, Marketing N.A.

Unnamed
(CaF_2, 5,000 tpy)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - #648,200
(including #93,500 working capital)

Unnamed
(AlF_3, 5,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

Economic Availability Study

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8566

Type of Ore: waste fluosilicic acid (H_2SiF_6) generated in processing phosphate rock to produce fertilizers and other phosphate products

Type of Mill: Chemical process ①

Products: Aluminum fluoride (AlF_3)

Yards or Tons per Day or Shift: 3000 tpy input

Operators Wages: $3.00-$3.25/hr

No. of Employees: 13

Type of Crushing & Grinding: N.A.

Source of Power: N.A.

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: $52,64

Direct Costs per ton: $242.86

Fixed Costs per ton: $38.83

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $334.33

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Exhaust gases to air scrubbers

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① The overall chemical reaction is:

$$2Al(OH)_3 + H_2SiF_6 = 2AlF_3 + SiO_2 + 4H_2O$$

② from phosphoric acid or fertilizer production - 37% overall
from normal superphosphate production - 20% overall
from triple superphosphate production - 4% overall
from nitraphosphates production - 31% overall

unnamed

AlF_3, 5,000 tpy

Indirect Costs

Labor, Management, Supervision, Clerical -$12.97

Mine Office, Warehouse - $28.89 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance -$10.78

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor -$21.71

Maintenance Labor - $5.04

Operating Supplies, Powder, Steel - $32.49

Utilities - $12.04

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Production chemicals - $171.58

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) - $10.49 (taxes and insurance)

Depreciation - $28.34 (Depreciation and deferred expenses)

Interest N.A

General Management N.A

Selling, Marketing N.A

Unnamed
AlF$_3$, 5,000 tpy)

Capital Costs

- Working Capital
- Purchase Cost
- Capitalization of Exploration and Development
- Roads and other local construction
- Capitalization of Equipment
- Capitalization of Plant

Total capital requirements - $2,642,500 (including $295,500 working capital)

Unnamed
(AlF_3, 25,000 tpy)

MILLING COST DATA

Year: 1971

Minerals or Ore: Fluorine

State: Florida (main area)

Economic Availability Study

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8566

Type of Ore: Waste fluosilicic acid (H_2SiF_6) generated in processing phosphate rock to produce fertilizers and other phosphate products

Type of Mill: Chemical process ①

Products: Aluminum Fluoride (AlF_3)

Yards or Tons per Day or Shift: 25,000 tpy input

Operators Wages: \$3.00 - \$3.25 /hr

No. of Employees: 24

Type of Crushing & Grinding: N.A.

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton: \$16.28

Direct Costs per ton: \$208.45

Fixed Costs per ton: \$17.76

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: \$242.48

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Exhaust gases to air scrubbers

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① The overall chemical reaction is:

$2Al(OH)_3 + H_2SiF_6 = 2AlF_3 + SiO_2 + 4H_2O$

② from phosphoric acid or fertilizer production - 37% overall
from normal superphosphate production - 20% overall
from triple superphosphate production - 40% overall
from nitraphosphate production - 31% overall

Unnamed
(F, 25,000 tpy)

Indirect Costs

Labor, Management, Supervision, Clerical - $2.59

Mine Office, Warehouse - $10.89 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - #2.80

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - #7.86

Maintenance Labor - #2.03

Operating Supplies, Powder, Steel - #14.80

Utilities - #12.02

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Production chemicals - #171.74

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) - # 4.80 (taxes and insurance)

Depreciation - #12.96 (Depreciation and deferred expenses)

Interest N.A

General Management N.A

Selling, Marketing N.A

Unnamed
(F, 25,000 tpy)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total capital requirements - $6,381,500
(including $987,400 working capital)

GOLD

Alice

MILLING COST DATA

Minerals or Ore: Gold, silver, copper **Year:** 1936

State: Colorado

District or County: Upper Fall River mining district, Clear Creek County

Mill: The Alice Mill

Owner or Operator: American Smelting & Refining Co.

Source of Information: IC 7058

Type of Ore:
The ore consists principally of pyrite with a subordinate amount of calcopyrite in a gangue of ①

Type of Mill: Flotation and amalgamation

Products: Gold, silver, copper conc.

Yards or Tons per Day or Shift:
200 Tons / day

Operators Wages:
$4 - $5 / shift

No. of Employees: 9

Type of Crushing & Grinding: ②

Source of Power:
Public Service Company of Colorado

% Recovery:
Gold - 82%, Silver - 70%, Copper - 70%

Distance to Smelter:
③

Water Source:
Creek from Loch Lomond

How Shipped:
Railroad

Indirect Costs per ton: $0.029

Direct Costs per ton: $0.715

Fixed Costs per ton: $0.040

Capitalization Costs per ton: N.A.

Rehabilitation Costs per ton: N.A

Total Milling costs per ton: $0.784

Shipping costs per ton: $6.78

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A.

Remarks:

over

① quartz and siderite. Gold appears to be associated principally with the copper minerals, especially with the secondary sulphides and malachite

② 15"x38" jaw crusher set at 2½"
↓
6'x8' cylindrical ball mill
↓
2'x3' trommel with ⅛"x½" punched slots

③ Concentrates hauled to Idaho Springs (78¢/ton) and loaded into railroad cars and shipped to the American Smelting and Refining Co. copper smelter at Garfield Utah.

Alice

Indirect Costs

Labor, Management, Supervision, Clerical - $0.029

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor
Maintenance Labor } - $0.234

Operating Supplies, Powder, Steel - $0.264

Utilities - $0.114

Transportation Mine to Mill - $0.103 (includes hauling concentrate to Idaho Spgs)

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.040 (taxes and insurance)

Depreciation N.A.

Interest N.A

General Management N.A

Selling, Marketing N.A

Alice

Capital Costs N.A.

- Working Capital
- Purchase Cost
- Capitalization of Exploration and Development
- Roads and other local construction
- Capitalization of Equipment
- Capitalization of Plant

Yellow Aster

MILLING COST DATA

Minerals or Ore: Gold

Year: 1940

State: California

District or County: Kern County

Mill: Yellow Aster Gold Mine Mill

Owner or Operator: Anglo American Mining Corp., Ltd.

Source of Information: IC 7096

Type of Ore: The ore bodies occur in granite that has intruded the schist. NW strike and a vertical or N.E. dip.

Type of Mill: Cyanidation

Yards or Tons per Day or Shift: 1000 tons/day

No. of Employees: 22

Source of Power: Nevada-California Power Corp.

Distance to Smelter: N.A.

How Shipped: N.A.

Products: Gold concentrate

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: N.A.

Water Source: Wells

Indirect Costs per ton: $0.1139

Direct Costs per ton: $0.4194

Fixed Costs per ton: $0.0094

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $0.5427

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: Tailings dam

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① 60" x 48" jaw crusher
↓
4' Gyratory crusher
↓
3' x 8' Hardinge ball mill

Yellow Aster

Indirect Costs

Labor, Management, Supervision, Clerical - $0.106

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance - $0.0079

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor }

Maintenance Labor } - $0.1057

Operating Supplies, Powder, Steel - $0.1636

Utilities - $0.1407

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Assaying - $0.0094

Fixed Costs

Property Taxes N.A

Other Fixed Taxes (Severance) N.A

Depreciation N.A

Interest N.A

General Management N.A

Selling, Marketing - $0.0094

Yellow Aster

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

London- Butt

MILLING COST DATA

Minerals or Ore: Gold, Silver, Lead

Year: 1937

State: Colorado

District or County: Park County

Mill: London-Butte Gold Mine Mill

Owner or Operator: London-Butte Gold Mines Co

Source of Information: I C 7101

Type of Ore: The quartz in the veins is of a glassy, milky variety. In addition to free gold, the veins contain pyrite ①

Type of Mill: Gravity- Flotation

Products: Gold, silver, lead concentrate

Yards or Tons per Day or Shift: 200 tons/day processed

Operators Wages: $4.65 - $5.75/shift

No. of Employees: 10

Type of Crushing & Grinding: ②

Source of Power: Public Service Co. of Colorado.

% Recovery: 92.79% for gold

Distance to Smelter: 80 miles

Water Source: The mine

How Shipped: Truck

Indirect Costs per ton:	$0.143
Direct Costs per ton:	$1.473
Fixed Costs per ton:	N.A.
Capitalization Costs per ton:	N.A
Rehabilitation Costs per ton:	N.A
Total Milling costs per ton:	$1.616
Shipping costs per ton:	$4.50 - $5.50

Method of Tailings Disposal: Tailings dam

Method of Rehabilitation of Tailings:

Remarks:

over ↓

① galena, chalcopyrite, sphalerite, and fragments of shale and porphyry. A limestone formation contains nearly all the silver-lead replacement deposits

② Oversize ore broken with hammers
↓
10"x16" jaw crusher set at 1½"
↓
2' cone crusher set at ⅜"
↓
6'x6' cylindrical ball mill

London-Butte

Indirect Costs

Labor, Management, Supervision, Clerical -$0.106

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance -$0.024

Union Welfare, etc. N.A.

Medical and Life Insurance -$0.013

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor -$0.510

Maintenance Labor -$0.088

Operating Supplies, Powder, Steel -$0.256

Utilities -$0.408

Transportation Mine to Mill N.A

Freight, Supplies Delivered -$0.059

Future Development Costs N.A

Maintenance and Service of Equipment -$0.048

Assays -$0.084

Miscellaneous -$0.020

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

London-Butte

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Yellow Pine

MILLING COST DATA

Minerals or Ore: Gold, Silver, Antimony **Year:** 1940

State: Idaho

District or County: Valley County

Mill: Yellow Pine concentrator

Owner or Operator: Bradley Mining Co.

Source of Information: IC 7194

Type of Ore: Pyrite and arsenopyrite disseminated through more or less altered granodiorite - aplite country rock. Stib[illegible]

Type of Mill: Flotation

Products: Gold, silver concentrate

Yards or Tons per Day or Shift: 14,000 tons/month

Operators Wages: N.A.

No. of Employees: N.A

Type of Crushing & Grinding: ②

Source of Power: Hydroelectric plants, [illegible]

% Recovery: mill recovery 70%, economic recovery 6

Distance to Smelter: approximately [illegible] mi

Water Source: ③

How Shipped: Truck then railroad

Indirect Costs per ton: . . . . N.A

Direct Costs per ton: $0.1850

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $0.1850

Shipping costs per ton: . . . . $9 - $10

Method of Tailings Disposal: tailings pond

Method of Rehabilitation of Tailings: N.A

Remarks: [illegible]

① occurs on the west side of the ore zone disseminated through the ore and in high-grade stringers.

② 24" x 36" Blake-type jaw crusher.
↓
No. 5 Gates gyratory crusher
↓
3-foot Symons cone crusher
↓
8'x3' and 5'x4' Hardinge ball mill

(3) Mill water comes from a dam on the South Fork of Meadow Creek. Water for power comes from Meadow Creek and its South Fork and from the East Fork of the South Fork of the Salmon River

Yellow Pine

Indirect Costs N.A

Labor, Management, Supervision, Clerical

Mine Office, Warehouse

Payroll Overhead - Social Security, Insurance

Union Welfare, etc.

Medical and Life Insurance

Royalties

Pension Funds

Severance Tax

Rehabilitation Costs

Direct Operating Costs

Production Labor } $0.2740 (labor)

Maintenance Labor }

Operating Supplies, Powder, Steel + $0.2895

Utilities

Transportation Mine to Mill

Freight, Supplies Delivered

Future Development Costs

Maintenance and Service of Equipment

Miscellaneous - $0.2215

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

Yellow Pine

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

IRON

Groveland

MILLING COST DATA

Year: 1960

Minerals or Ore: Iron

State: Michigan

District or County: Dickinson County

Mill: Groveland Mine and Mill

Owner or Operator: The Hanna Mining Co.

Source of Information: IC 8181

Type of Ore:
The main iron bearing minerals are hematite magnetite and iron rich silicates, Gangue is jasper and quartz.

Type of Mill: Flotation

Products: iron concentrate

Yards or Tons per Day or Shift:
2,000 tons/day (concentrate)

Operators Wages: N.A.

No. of Employees: 134

Type of Crushing & Grinding: ①

Source of Power:
Wisconsin-Michigan Power Co.

% Recovery:
25 weight % of mine run

Distance to Smelter:

Water Source:
North branch Sturgeon River

How Shipped: Railroad, ships

Indirect Costs per ton: . . . . 14.95% of millcost

Direct Costs per ton: . . . . 53.96% of millcost

Fixed Costs per ton: . . . . 31.10% of millcost

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . 100% of mill cost

Shipping costs per ton: . . . . variable

Method of Tailings Disposal: tailings pond

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

Groveland

Indirect Costs

Labor, Management, Supervision, Clerical N.A

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance - 1.62% of MC (insurance and administration)

Union Welfare, etc. — 4.85% of C (employee benefits)

Medical and Life Insurance N.A

Royalties - 8.48% of MC

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor
Maintenance Labor
Operating Supplies, Powder, Steel
Utilities
} 53.96% of MC (mill cost)

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance)
Depreciation
} 31.10% of MC (depreciation & Taxes)

Interest N.A

General Management N.A

Selling, Marketing N.A

Groveland

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Iron Mountain

MILLING COST DATA

Year: 1955

Minerals or Ore: Iron

State: Missouri

District or County: St. Francois County

Mill: Iron Mountain Mine Mill

Owner or Operator: Ozark Ore Co.

Source of Information: IC 7807

Type of Ore: The chief ore mineral is a hard, blue specular hematite, with some magnetite. The gangue minerals ①

Type of Mill: Gravity Concentration

Products: Iron concentrate

Yards or Tons per Day or Shift: 2,400 long tons / day processed

Operators Wages: ④

No. of Employees: 36

Type of Crushing & Grinding: ②

Source of Power: Arkansas - Missouri Power Co.

% Recovery: ③

Distance to Smelter: approximately 100 miles

Water Source: water pumped from mine

How Shipped: Railroad

Indirect Costs per ton: . . . . 6.01% of MC (mill cost)

Direct Costs per ton: . . . . 93.99% of MC

Fixed Costs per ton: . . . . N.A.

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . 100% of MC

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① include andradite garnet, tremolite, actinolite amphiboles, chlorite, quartz, and apatite. The country rock is fine-grained andesite, porphyritic in places. The specific gravity of high grade ore is 4.70.

② 30" by 42" Pioneer jaw crusher
↓
10" by 36" Kue-Ken jaw crusher
↓
4-foot Symons cone crusher
↓
7' x 12' Hardinge rod mill

③ Metallurgical recovery - 86.85%
Weight recovery (dry basis) - 61.23%

④ Wage rates are the same as those at all major iron mines. Pay differential: 6¢/hr on afternoon shift, 9¢/hr for night shift.

Iron Mountain

Indirect Costs

Labor, Management, Supervision, Clerical - 6.01 % of MC (milling costs)

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - 35.35 % of MC (milling cost)

Maintenance Labor - 8.68 % of MC

Operating Supplies, Powder, Steel } 49.93% of MC

Utilities

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A.

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Iron Mountain

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

LEAD

Unnamed
(Pb 4,200 tpd

MILLING COST DATA

Year: 1974

Mineral Supply Study

Minerals or Ore: Lead

State: N.A

District or County: N.A

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: I C 8646

Type of Ore: Lead-silver and lead-zinc-silver replacement deposits in carbonate rock

Type of Mill: Flotation

Yards or Tons per Day or Shift: 4,200 tons/day

No. of Employees: N.A

Source of Power: N.A.

Distance to Smelter: N.A

How Shipped: N.A.

Products: Pb/Zn concentrate

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: ②

Water Source: N.A

Indirect Costs per ton: $0.515

Direct Costs per ton: $1.350

Fixed Costs per ton: $0.503

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $2.368

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① Primary crusher
↓
Secondary crusher
↓
Rod Mill
↓
Ball Mill

② Lead - 90%
Silver - 90%
Copper - 87%
Zinc - 92%

Unnamed
(Pb 4,200 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.065

Mine Office, Warehouse - $0.205 (General expenses)

Payroll Overhead - Social Security, Insurance - $0.193

Union Welfare, etc. N.A

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Plant overhead - $0.052

Direct Operating Costs

Production Labor - $0.104

Maintenance Labor - $0.175

Operating Supplies, Powder, Steel - $0.627

Utilities - $0.344

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Tailings disposal - $0.10

Fixed Costs

Property Taxes - $0.087

Other Fixed Taxes (Severance)

Depreciation - $0.416

Interest N.A.

General Management N.A.

Selling, Marketing N.A

Unnamed
(Pb 4,200 tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(Pb 2,600 tpd)

MILLING COST DATA

Year: 1974

Mineral Supply Study

Minerals or Ore: Lead

State: N.A

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8646

Type of Ore: Lead-silver and lead-zinc-silver replacement deposits in carbonate rock

Type of Mill: Flotation

Products: Pb/Zn Concentrate

Yards or Tons per Day or Shift: 2,600 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: ①

Source of Power: N.A.

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A

Indirect Costs per ton: $0.596

Direct Costs per ton: $1.488

Fixed Costs per ton: $0.601

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $2.685

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① Primary Crusher
↓
Secondary Crusher
↓
Rod Mill
↓
Ball Mill

② Lead - 90%
Silver - 90%
Copper - 87%
Zinc - 92%

Unnamed
(Pb 2,600 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.065

Mine Office, Warehouse - $0.233 (General expenses)

Payroll Overhead - Social Security, Insurance - $0.230

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A.
Plant overhead - $0.068

Direct Operating Costs

Production Labor - $0.136

Maintenance Labor - $0.209

Operating Supplies, Powder, Steel - $0.671

Utilities - $0.372

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A
Tailings disposal - $0.100

Fixed Costs

Property Taxes - $0.104

Other Fixed Taxes (Severance) N.A

Depreciation - $0.497

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Unnamed
(Pb 2,600 tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(Pb 1,000tpd)

MILLING COST DATA

Year: 1974

Minerals or Ore: Lead

State: N.A.

Mineral Supply Study

District or County: N.A

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8646

Type of Ore:
Lead-silver and lead-zinc-silver replacement deposits in carbonate rocks.

Type of Mill: Flotation

Products: Pb/Zn Concentrate

Yards or Tons per Day or Shift: 1,000 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: ①

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: $0.919

Direct Costs per ton: $1.923

Fixed Costs per ton: $0.876

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $3.718

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① Primary crusher
↓
secondary crusher
↓
Rod mill
↓
Ball mill

② Lead - 90%
Silver - 90%
Copper - 87%
Zinc - 92%

Unnamed
(Pb 1,000tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.097

Mine Office, Warehouse - $0.323 (General expense)

Payroll Overhead - Social Security, Insurance - $ 0.363

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Plant overhead - $0.136

Direct Operating Costs

Production Labor - $0.272

Maintenance Labor - $0.304

Operating Supplies, Powder, Steel - $0.794

Utilities - $0.453

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Tailings disposal - $0.10

Fixed Costs

Property Taxes - $0.152

Other Fixed Taxes (Severance) N.A.

Depreciation - $0.724

Interest N.A

General Management N.A.

Selling, Marketing N.A.

Unnamed
(Pb 1000tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(Pb 1,600 tpd)

MILLING COST DATA

Year: 1974

Mineral Supply Study

Minerals or Ore: Lead

State: N.A

District or County: N.A

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8646

Type of Ore:
Lead-silver and lead-zinc-silver replacement deposits in carbonate rock.

Type of Mill: Flotation

Products: Pb/Zn Concentrate

Yards or Tons per Day or Shift:
1,600 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: ①

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton: $0.729

Direct Costs per ton: $1.666

Fixed Costs per ton: $0.703

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $3.098

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over↓

① Primary Crusher
↓
Secondary Crusher
↓
Rod Mill
↓
Ball Mill

② Lead - 90%
Silver - 90%
Copper - 87%
Zinc - 92%

Unnamed
(Pb 1,600 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.084

Mine Office, Warehouse - $0.269 (General expenses)

Payroll Overhead - Social Security, Insurance - $0.282

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Plant overhead - $0.094

Direct Operating Costs

Production Labor - $0.187

Maintenance Labor - $0.244

Operating Supplies, Powder, Steel - $0.712

Utilities - $0.422

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Tailings disposal - $0.10

Fixed Costs

Property Taxes - $0.122

Other Fixed Taxes (Severance) N.A

Depreciation - $0.581

Interest N.A

General Management N.A.

Selling, Marketing N.A

Unnamed
(Pb 1,600 tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(Pb 600tpd)

MILLING COST DATA

Year: 1974

Minerals or Ore: Lead

State: N.A

Mineral Supply Study

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8646

Type of Ore: Lead-silver and lead-zinc-silver replacement deposits in carbonate rocks.

Type of Mill: Flotation

Products: Pb/Zn Concentrate

Yards or Tons per Day or Shift: 600 tons/day

Operators Wages: N.A.

No. of Employees: N.A.

Type of Crushing & Grinding: ②

Source of Power: N.A

% Recovery: ①

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A

Indirect Costs per ton: $1.233

Direct Costs per ton: $2.222

Fixed Costs per ton: $1.061

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $4.516

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① Lead - 90%
Silver - 90%
Copper - 87%
Zinc - 92%

② Primary crusher
↓
Secondary crusher
↓
Rod mill
↓
Ball mill

Unnamed
(Pb 600tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.157

Mine Office, Warehouse - $0.392 (General Expense)

Payroll Overhead - Social Security, Insurance - $0.480

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.

Plant overhead - $0.204

Direct Operating Costs

Production Labor - $0.408

Maintenance Labor - $0.368

Operating Supplies, Powder, Steel - $0.879

Utilities - $0.467

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Tailings Disposal - $0.10

Fixed Costs

Property Taxes - $0.184

Other Fixed Taxes (Severance)

Depreciation - $0.877

Interest N.A

General Management N.A.

Selling, Marketing N.A.

Unnamed
(Pb 600 tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(Pb 11,00 Tpd)

MILLING COST DATA

Year: 1974

Minerals or Ore: Lead

State: N.A

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8646

Type of Ore: Lead-silver and lead-zinc-silver replacement deposits in carbonate rock

Type of Mill: Flotation

Products: Pb/Zn concentrate

Yards or Tons per Day or Shift: 11,000 Tons/day

Operators Wages: N.A.

No. of Employees: N.A

Type of Crushing & Grinding: ①

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton: $0,354

Direct Costs per ton: $1.120

Fixed Costs per ton: $0.371

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $1,845

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① Primary Crusher
↓
Secondary Crusher
↓
Rod Mill
↓
Ball Mill

②
Lead - 90%
Silver - 90%
Copper - 87%
Zinc - 92%

Unnamed
(Pb 11,000 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.038

Mine Office, Warehouse - $0.160

Payroll Overhead - Social Security, Insurance - $0.130

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Plant overhead - $0.026

Direct Operating Costs

Production Labor - $0.052

Maintenance Labor - $0.129

Operating Supplies, Powder, Steel - $0.566

Utilities - $0.273

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A.

Tailings disposal - $0.100

Fixed Costs

Property Taxes - $0.064

Other Fixed Taxes (Severance) N.A.

Depreciation - $0.307

Interest N.A

General Management N.A

Selling, Marketing N.A.

Unnamed
(Pb 11,000 tpd)

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(Pb 6,800 tpd)

MILLING COST DATA

Year: 1974

Mineral Supply Study

Minerals or Ore: Lead

State: N.A.

District or County: N.A.

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8646

Type of Ore: Lead-silver and lead-zinc-silver replacement deposits in carbonate rock.

Type of Mill: Flotation

Yards or Tons per Day or Shift: 6,800 tons/day

No. of Employees: N.A.

Source of Power: N.A.

Distance to Smelter: N.A.

How Shipped: N.A

Products: Pb/Zn Concentrate

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: ②

Water Source: N.A.

Indirect Costs per ton: $0.423

Direct Costs per ton: $1.218

Fixed Costs per ton: $0.431

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $2.072

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① Primary Crusher
↓
Secondary Crusher
↓
Rod Mill
↓
Ball Mill

② Lead - 90%
Silver 90%
Copper - 87%
Zinc - 92%

Unnamed
(Pb 6,800 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.050

Mine Office, Warehouse - $0.180 (General expenses)

Payroll Overhead - Social Security, Insurance - $0.157

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Plant overhead - $0.036

Direct Operating Costs

Production Labor - $0.072

Maintenance Labor - $0.149

Operating Supplies, Powder, Steel - $0.595

Utilities - $0.306

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Tailings disposal - $0.096

Fixed Costs

Property Taxes - $0.075

Other Fixed Taxes (Severance) N.A.

Depreciation - $0.356

Interest N.A

General Management N.A

Selling, Marketing N.A

Unnamed
(Pb 6,800 tpd)

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Madison

MILLING COST DATA

Year: 1956

Minerals or Ore: Lead

State: Missouri

District or County: Madison County

Mill: Madison Mill

Owner or Operator: National Lead Company

Source of Information: IC 8028

Type of Ore: Galena and pyrite occur in a disseminated manner in dolomite.

Type of Mill: Flotation

Yards or Tons per Day or Shift: 1400 tons / day

No. of Employees: 30

Source of Power: N.A.

Distance to Smelter: approximately 50 miles

How Shipped: Railroad

Products: ②

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: ③

Water Source: ④

Indirect Costs per ton: $0.183

Direct Costs per ton: $1.227

Fixed Costs per ton: . . . . N.A.

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $1.410

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① Primary crusher - Telsmith No. 13-B
- Symons short head cone crusher
- Hardinge ballmill Marcy Ballmill

② Lead concentrate
Copper concentrate
Iron concentrate

③ 93.51% of the lead
47.26% of the copper
64.72% of the cobalt
64.20% of the nickel

④ natural drainage, mine water, and overflow water from the tailings pond and is collected in a 10 acre reservoir.

Madison

Indirect Costs

Labor, Management, Supervision, Clerical - $0.183

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance N.A.

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $0.271

Maintenance Labor - $0.219

Operating Supplies, Powder, Steel - $0.576

Utilities - $0.161

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Madison

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Indian Creek

MILLING COST DATA

Year: 1956

Minerals or Ore: Lead, Zinc

State: Missouri

District or County: Washington County

Mill: Indian Creek Mine Mill

Owner or Operator: St. Joseph Lead Co.

Source of Information: IC 7875

Type of Ore: Galena associated with small quantities of sphalerite and marcasite disseminated in dolomite.

Type of Mill: Flotation

Yards or Tons per Day or Shift: 2,000 Tons processed

No. of Employees: N.A.

Source of Power: Arkansas-Missouri Power Co.

Distance to Smelter: ②

How Shipped: railroad

Products: Pb Concentrate
Zn Concentrate

Operators Wages: N.A.

Type of Crushing & Grinding: ①

% Recovery: 97.57% Pb, 89.29% Zn

Water Source: Fourche-a-Renault creek and the mine

Indirect Costs per ton: . . . . 5.52% of TC

Direct Costs per ton: . . . . 94.48% of TC

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . 100% of TC

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A

Remarks:

① 25-B gyratory crusher (primary)
↓
Allis Chalmers 460 Hydrcone crusher
↓
rodmill
↓
Allis Chalmers ball mill

② Lead concentrate ≈ 30 miles
Zinc concentrate - Josephtown, Pennsylvania

Indian Creek

Indirect Costs

Labor, Management, Supervision, Clerical - 5.52% of TC

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A

Medical and Life Insurance N A

Royalties N.A

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor -16.39% of TC

Maintenance Labor -7.30% of TC

Operating Supplies, Powder, Steel } 70.79 % of TC

Utilities

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A.

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Indian Creek

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

MILLING COST DATA

Year: 1946

Minerals or Ore: Lead, Zinc

State: Idaho

District or County: Shoshone County, Yreka mining district

Mill: Little Pittsburg Mill

Owner or Operator: Denver Development Co.

Source of Information: IC 7428

Type of Ore:
A fine-grained mixture of sphalerite, galena, pyrite, and pyrrhotite in a gangue of unreplaced argillite and quartz.

Type of Mill: Flotation

Yards or Tons per Day or Shift: 150 tons/day

No. of Employees: N.A

Source of Power: Washington Water Power Co.

Distance to Smelter: 5 miles

How Shipped: Truck

Products: Zinc, Lead Concentrates

Operators Wages: $9.73/shift

Type of Crushing & Grinding: ①

% Recovery: Lead-90.7%, Zinc-92.0%

Water Source: mine, Denver Creek, Trapper creek

Indirect Costs per ton: $1.5735

Direct Costs per ton: $2.3635

Fixed Costs per ton: $0.3056

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $4.2426

Shipping costs per ton: $1.25

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

①

9" x 15" jaw crusher
↓
No. 22 Fahrenwald Swing-Head Cone Crusher (24")
↓
8' x 36" Ball Mill

Indirect Costs

Labor, Management, Supervision, Clerical - $1.2004

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.
miscellaneous - $0.3731

Direct Operating Costs

Production Labor
Maintenance Labor } $0.7806 (labor)

Operating Supplies, Powder, Steel - $0.982

Utilities - $0.3007

Transportation Mine to Mill N.A

Freight, Supplies Delivered - $0.1950 (concentrate & supplies)

Future Development Costs N.A.

Maintenance and Service of Equipment N.A.
transportation of men - $0.1052

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.3056 (taxes)

Depreciation N.A.

Interest N.A.

General Management N.A

Selling, Marketing N.A.

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Tennessee - Schuylkill

MILLING COST DATA

Year: 1938

Minerals or Ore: Lead, Zinc

State: Arizona

District or County: Wallapai mining district

Mill: Tennessee - Schuylkill Mine and Mill

Owner or Operator: Tennessee - Schuylkill Corp.

Source of Information: IC7077

Type of Ore:
Galena, fine grained gold bearing pyrite, and sphalerite in a gangue consisting chiefly of quartz and soft, ①

Type of Mill: Selective Flotation

Products: Lead Concentrate, Zinc Concentrate

Yards or Tons per Day or Shift:
150 tons/day

Operators Wages: $4.00-$5.00/shift

No. of Employees: 12

Type of Crushing & Grinding: ②

Source of Power:
Citizen's Utility Co., Kingman Ariz.

% Recovery:
Pb-97.7%, Zn-88.5%, Au-95.9%, Ag-94.4%

Distance to Smelter:
③

Water Source:
Tailing pond, mine

How Shipped:
N.A.

Indirect Costs per ton: $0.2926

Direct Costs per ton: $1.0944

Fixed Costs per ton: . . . . N.A.

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $1.387

Shipping costs per ton: . . . . $6.65- $11.50 ④

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

① altered fragments of wall rock. The ore also contains small amounts of crystalline pyrite and arsenopyrite. The ore shoots generally rake northward above the 900-ft level and tend to change to nearly vertical between the 900 and 1,400 foot levels.

② 10" x 20" Allis Chalmers jaw crusher set at ¾"
↓
6' x 4½' Marcy ball mill (3" dia. forged steel balls)

③ Distance to smelter for lead concentrate is approximately 400 miles (El Paso, Texas)
Distance to smelter for zinc concentrate is approximately 600 miles (Amarillo, Texas)

④

Concentrates:	Lead	Zinc	Jig
To Kingman, Az	$1.50	$1.50	$1.50
To smelter	$5.50 (El Paso, Tx)	$5.15 (Amarillo, Tx)	$10.00
shipping charge/ton:	$7.00	$6.65	$11.50

Tennessee - Schuylkill

Indirect Costs

Labor, Management, Supervision, Clerical - $0.1105

Mine Office, Warehouse - $0.1329 (miscellaneous and office expense)

Payroll Overhead - Social Security, Insurance - $0.0218 (unemployment tax and old age benefit tax)

Union Welfare, etc. N.A

Medical and Life Insurance - $0.0174

Royalties - $0.0100

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor — $0.2746

Maintenance Labor - $0.0740

Operating Supplies, Powder, Steel - $0.3830

Utilities - $0.3628

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs N.A.

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Tennessee- Schuylkill

Capital Costs N.A

Working Capital

— Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

— Capitalization of Equipment

Capitalization of Plant

MANGANESE

Mohave

MILLING COST DATA

Year: 1959

Minerals or Ore: Manganese

State: Arizona

District or County: Maricopa County

Mill: Mohave Mining and Milling Co.

Owner or Operator: Mohave Mining and Milling Co.

Source of Information: IC 8144

Type of Ore: Ramsdellite (MnO_2). The gangue is composed mostly of host rock and minor stringers of calcite and quartz.

Type of Mill: Gravity separation, flotation, or a combination of the two.

Yards or Tons per Day or Shift: 750 tons/day

Products: Manganese concentrate

No. of Employees: 39

Operators Wages: N.A.

Source of Power: Arizona Public Service Co.

Type of Crushing & Grinding: impact & cone crusher

Distance to Smelter: 7 miles (sintering plant)

% Recovery: 44% Mn Concentrate

How Shipped: Truck

Water Source: Hassayampa River

Indirect Costs per ton: . . . . 6.4% of mill costs

Direct Costs per ton: . . . . 936.% of mill costs

Fixed Costs per ton: . . . . N.A.

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: . . . . 100% of mill costs

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

Mohave

Indirect Costs

Labor, Management, Supervision, Clerical -6.4% of milling cost

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance N.A.

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - 25.9% of milling costs

Maintenance Labor - 9.2% of milling costs

Operating Supplies, Powder, Steel } 49.0% of milling costs

Utilities

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment - 9.5% of milling costs

Fixed Costs N.A.

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Mohave

__Capital Costs__ N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

NICKEL

Unnamed
(Ni - 15,000 tpd)

MILLING COST DATA

Year: 1970

Minerals or Ore: Nickel

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8469

Type of Ore:
Copper-Nickel sulfide ore consisting mainly of peridotite and oxide deposits of nickeliferous laterite, occurring as①

Type of Mill: Flotation

Products: Ni-Cu Concentrate

Yards or Tons per Day or Shift: 15,000 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: N.A

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton:	$0.352
Direct Costs per ton:	$1.077
Fixed Costs per ton:	$0.298
Capitalization Costs per ton:	N.A
Rehabilitation Costs per ton:	N.A
Total Milling costs per ton:	$1.727
Shipping costs per ton:	N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① weathering mantles atop serpentine or peridotite

② See attached sheet

Unnamed
(Ni 15,000 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.007

Mine Office, Warehouse - $0.150 (General Expense)

Payroll Overhead - Social Security, Insurance - $0.108

Union Welfare, etc.

Medical and Life Insurance

Royalties

Pension Funds

Severance Tax

Rehabilitation Costs
Laboratory - $0.024
Plant overhead - $0.063

Direct Operating Costs

Production Labor — $0.127

Maintenance Labor - $0.103

Operating Supplies, Powder, Steel - $0.634

Utilities - $0.213

Transportation Mine to Mill

Freight, Supplies Delivered

Future Development Costs

Maintenance and Service of Equipment

Fixed Costs

Property Taxes - $0.052

Other Fixed Taxes (Severance)

Depreciation - $0.246

Interest

General Management

Selling, Marketing

unnamed
(Ni 15,000 tpd)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TABLE 8. - Predesign financial summary for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Annual throughput (350-day year)....................tons..	35,000	350,000	5,250,000	10,500,000
Total capital investment....................................	$703,000	$2,553,100	$20,765,600	$37,087,800
Depreciation, annual (14-year period)....................	43,700	158,600	1,289,800	2,303,600
Operating cost, annual.......................................	343,200	1,041,000	9,057,000	16,434,000
Operating cost, per ton of throughput.....................	9.80	2.97	1.73	1.56
Annual payment to return capital and give 12 percent annual return on total capital investment over a 14-year period..	106,100	385,200	3,132,900	5,595,500
Less depreciation..	43,700	158,600	1,289,800	2,303,600
Equals net income..	62,400	226,600	1,843,100	3,291,900
Taxable income (at 50 percent tax rate = 2 × net income)..	124,800	453,200	3,686,200	6,583,800
Total revenue (taxable income + annual operating cost)..	468,000	1,494,200	12,743,200	22,832,600
Required revenue per ton of throughput....................	13.37	4.27	2.43	2.19

TABLE 9. - Predesign capital cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Estimated delivered equipment (P)........................	$146,800	$529,400	$4,283,000	$7,623,500
Equipment installation (43 percent of P)..................	63,100	227,600	1,841,700	3,278,100
Pipe, installation and insulation (36 percent of P).........	52,800	190,600	1,541,900	2,744,500
Electrical installation (15 percent of P)..................	22,000	79,400	642,400	1,143,500
Buildings including services (35 percent of P).............	51,400	185,300	1,499,100	2,668,200
Yard improvements (10 percent of P)......................	14,700	52,900	428,300	762,400
Service facilities (35 percent of P).......................	51,400	185,300	1,499,100	2,668,200
Land (6 percent of P).......................................	8,800	31,800	257,000	457,400
Total physical cost (PC)................................	411,000	1,482,300	11,992,500	21,345,800
Engineering and construction (20 percent of PC)............	82,200	296,500	2,398,500	4,269,200
Direct plant cost (DPC).................................	493,200	1,778,800	14,391,000	25,615,000
actor's fee (7 percent of DPC)............................	34,500	124,500	1,007,400	1,793,100
ingency (15 percent of DPC)..............................	74,000	266,800	2,158,600	3,842,200
Tailings pond site preparation.............................	10,000	50,000	500,000	1,000,000
Total estimated fixed capital investment................	611,700	2,220,100	18,057,000	32,250,300
Working capital (15 percent of total fixed capital)........	91,800	333,000	2,708,600	4,837,500
Total estimated capital investment......................	703,500	2,553,100	20,765,600	37,087,800

TABLE 10. - Predesign annual operating cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Direct costs:				
Operating labor..	$75,900	$94,900	$664,300	$854,100
Supervision..	12,000	14,000	35,000	85,400
Maintenance:				
Labor (3 percent of fixed capital)......................	18,400	66,600	541,700	967,500
Supplies (3 percent of fixed capital)....................	18,400	66,600	541,700	967,500
Plant supplies...	23,000	194,900	2,788,600	5,526,900
Utilities..	27,500	180,700	1,115,900	2,274,200
Total direct costs......................................	175,200	617,700	5,687,200	10,675,600
Indirect costs:				
Payroll overhead (27.5 percent of labor cost)............	29,200	48,300	341,300	524,400
Laboratory (10 percent of labor cost)....................	10,600	17,600	124,100	190,700
Plant overhead (50 percent operating labor)...............	37,900	47,400	332,200	427,000
Total indirect costs....................................	77,700	113,300	797,600	1,142,100
Fixed costs:				
Depreciation (fixed capital ÷ 14 years)..................	43,700	158,600	1,289,800	2,303,600
Property taxes (1.5 percent of fixed capital)............	9,200	33,300	270,900	483,800
Insurance (1.25 percent of fixed capital)................	7,600	27,800	225,700	403,100
Total fixed costs.......................................	60,500	219,700	1,786,400	3,190,500
General expense: Administration and research (9.5 percent of direct, indirect, and fixed)..........................	29,800	90,300	785,800	1,425,800
Total operating cost....................................	343,200	1,041,000	9,057,000	16,434,000
ting cost per ton of throughput.........................	9.80	2.97	1.73	1.56

rail were based on information given by representatives of the Port of Portland Commission of Public Docks.

Transportation mode, distances, and costs for oxide resources are given in table 20; sulfide resource movements for nickel and copper are given in tables 21 and 22. All transportation between distant points in the contiguous 48 States has been assumed to be by rail. Further evaluation might show, in the case of several resource districts, that transport cost savings could be realized by using water transport through the St. Lawrence Seaway and the Great Lakes.

Cost Summary by District

The cost per pound of recovered nickel for each district is shown in table 23. Added to the mining, milling, and smelting cost is a royalty payment of $0.025 per pound of recoverable nickel to cover property acquisition. Recovery of nickel from sulfide resources is estimated by the equation

$$Y = \frac{0.4_x + 0.615}{1.35}$$

, where Y equals the percent of recovery, and X = the grade of the ore in percent. Nickel recovery from oxide ores is based on the smelter slag containing a constant 0.13 percent nickel, which means that as the grade of the material being smelted declines, the percent of nickel recovery also declines. Copper that would be obtained from the nickel sulfide ores as a concentrate is shown in table 24. The value of the copper is established on the basis of 90 percent of the copper being recovered in a 15-percent copper concentrate. Market value is assumed at $0.40 per pound of copper from which is deducted copper-smelter charges and transportation from mill to smelter. The smelter is assumed to pay for 95 percent of the market value ($0.40 per pound) less $0.035 per pound of copper. The net value of the copper is credited to the nickel recovery cost for each deposit (table 23).

Unnamed
(Ni 100tpd)

MILLING COST DATA

Year: 1970

Minerals or Ore: Nickel

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8469

Type of Ore:
Copper-Nickel sulfide ore consisting mainly of peridotite and oxide deposits of nikeliferous laterite occurring as ①

Type of Mill: Flotation

Products: Ni-Cu Concentrate

Yards or Tons per Day or Shift: 100 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: N.A

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton: $3.631

Direct Costs per ton: $4.664

Fixed Costs per ton: $1.512

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $9.807

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A.

Remarks:
see attached sheets

over ↓

① weathering mantles atop serpentine or peridotite

② see attached sheet

Unnamed
(Ni 100tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.343

Mine Office, Warehouse - $0.851 (General expense)

Payroll Overhead - Social Security, Insurance - $1.051

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.

Laboratory - $0.303

Plant overhead - $1.083

Direct Operating Costs

Production Labor - $2.169

Maintenance Labor - $0.526

Operating Supplies, Powder, Steel - $1.183

Utilities - $0.786

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes - $0.263

Other Fixed Taxes (Severance)

Depreciation - $1.249

Interest N.A

General Management N.A.

Selling, Marketing N.A

Unnamed
(Ni 100tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TABLE 8. - Predesign financial summary for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Annual throughput (350-day year)....................tons..	35,000	350,000	5,250,000	10,500,000
Total capital investment..................................	$703,000	$2,553,100	$20,765,600	$37,087,800
Depreciation, annual (14-year period).....................	43,700	158,600	1,289,800	2,303,600
Operating cost, annual....................................	343,200	1,041,000	9,057,000	16,434,000
Operating cost, per ton of throughput.....................	9.80	2.97	1.73	1.56
Annual payment to return capital and give 12 percent annual return on total capital investment over a 14-year period..	106,100	385,200	3,132,900	5,595,500
Less depreciation......................................	43,700	158,600	1,289,800	2,303,600
Equals net income......................................	62,400	226,600	1,843,100	3,291,900
Taxable income (at 50 percent tax rate = 2 × net income)..	124,800	453,200	3,686,200	6,583,800
Total revenue (taxable income + annual operating cost)..	468,000	1,494,200	12,743,200	22,832,600
Required revenue per ton of throughput....................	13.37	4.27	2.43	2.19

TABLE 9. - Predesign capital cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Estimated delivered equipment (P)............................	$146,800	$529,400	$4,283,000	$7,623,500
Equipment installation (43 percent of P).....................	63,100	227,600	1,841,700	3,278,100
Pipe, installation and insulation (36 percent of P).........	52,800	190,600	1,541,900	2,744,500
Electrical installation (15 percent of P)....................	22,000	79,400	642,400	1,143,500
Buildings including services (35 percent of P)...............	51,400	185,300	1,499,100	2,668,200
Yard improvements (10 percent of P)..........................	14,700	52,900	428,300	762,400
Service facilities (35 percent of P).........................	51,400	185,300	1,499,100	2,668,200
Land (6 percent of P)..	8,800	31,800	257,000	457,400
Total physical cost (PC)................................	411,000	1,482,300	11,992,500	21,345,800
Engineering and construction (20 percent of PC)..............	82,200	296,500	2,398,500	4,269,200
Direct plant cost (DPC).................................	493,200	1,778,800	14,391,000	25,615,000
actor's fee (7 percent of DPC)...............................	34,500	124,500	1,007,400	1,793,100
ingency (15 percent of DPC)..................................	74,000	266,800	2,158,600	3,842,200
Tailings pond site preparation...............................	10,000	50,000	500,000	1,000,000
Total estimated fixed capital investment...............	611,700	2,220,100	18,057,000	32,250,300
Working capital (15 percent of total fixed capital)..........	91,800	333,000	2,708,600	4,837,500
Total estimated capital investment.....................	703,500	2,553,100	20,765,600	37,087,800

TABLE 10. - Predesign annual operating cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Direct costs:				
Operating labor..	$75,900	$94,900	$664,300	$854,100
Supervision..	12,000	14,000	35,000	85,400
Maintenance:				
Labor (3 percent of fixed capital)......................	18,400	66,600	541,700	967,500
Supplies (3 percent of fixed capital)...................	18,400	66,600	541,700	967,500
Plant supplies...	23,000	194,900	2,788,600	5,526,900
Utilities..	27,500	180,700	1,115,900	2,274,200
Total direct costs.....................................	175,200	617,700	5,687,200	10,675,600
Indirect costs:				
Payroll overhead (27.5 percent of labor cost)..............	29,200	48,300	341,300	524,400
Laboratory (10 percent of labor cost)......................	10,600	17,600	124,100	190,700
Plant overhead (50 percent operating labor)................	37,900	47,400	332,200	427,000
Total indirect costs...................................	77,700	113,300	797,600	1,142,100
Fixed costs:				
Depreciation (fixed capital ÷ 14 years)....................	43,700	158,600	1,289,800	2,303,600
Property taxes (1.5 percent of fixed capital)..............	9,200	33,300	270,900	483,800
Insurance (1.25 percent of fixed capital)..................	7,600	27,800	225,700	403,100
Total fixed costs......................................	60,500	219,700	1,786,400	3,190,500
General expense: Administration and research (9.5 percent of direct, indirect, and fixed)..................................	29,800	90,300	785,800	1,425,800
Total operating cost...................................	343,200	1,041,000	9,057,000	16,434,000
ting cost per ton of throughput............................	9.80	2.97	1.73	1.56

rail were based on information given by representatives of the Port of Portland Commission of Public Docks.

Transportation mode, distances, and costs for oxide resources are given in table 20; sulfide resource movements for nickel and copper are given in tables 21 and 22. All transportation between distant points in the contiguous 48 States has been assumed to be by rail. Further evaluation might show, in the case of several resource districts, that transport cost savings could be realized by using water transport through the St. Lawrence Seaway and the Great Lakes.

Cost Summary by District

The cost per pound of recovered nickel for each district is shown in table 23. Added to the mining, milling, and smelting cost is a royalty payment of $0.025 per pound of recoverable nickel to cover property acquisition. Recovery of nickel from sulfide resources is estimated by the equation $Y = \frac{0.4_x + 0.615}{1.35}$, where Y equals the percent of recovery, and X = the grade of the ore in percent. Nickel recovery from oxide ores is based on the smelter slag containing a constant 0.13 percent nickel, which means that as the grade of the material being smelted declines, the percent of nickel recovery also declines. Copper that would be obtained from the nickel sulfide ores as a concentrate is shown in table 24. The value of the copper is established on the basis of 90 percent of the copper being recovered in a 15-percent copper concentrate. Market value is assumed at $0.40 per pound of copper from which is deducted copper-smelter charges and transportation from mill to smelter. The smelter is assumed to pay for 95 percent of the market value ($0.40 per pound) less $0.035 per pound of copper. The net value of the copper is credited to the nickel recovery cost for each deposit (table 23).

Unnamed
(Ni 1000tpd)

MILLING COST DATA

Minerals or Ore: Nickel

Year: 1970

State: N.A

District or County: N.A

Mineral Supply Stud

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: I.C 8469

Type of Ore:
Copper-Nickel sulfide ore consisting mainly of peridotite
and oxide deposits of nickeliferous laterite occurring as ①

Type of Mill: Flotation

Products: Ni-Cu Concentrate

Yards or Tons per Day or Shift: 1000 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: N.A

Source of Power: N.A.

% Recovery: ②

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A

Indirect Costs per ton:	$0.700
Direct Costs per ton:	$1.724
Fixed Costs per ton:	$0.548
Capitalization Costs per ton:	N.A.
Rehabilitation Costs per ton:	N.A.
Total Milling costs per ton:	$2.972
Shipping costs per ton:	N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① weathering mantles atop serpentine or peridotite

② See attached sheet

Unnamed
(Ni 1000 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.040

Mine Office, Warehouse - $0.258 (General expense)

Payroll Overhead - Social Security, Insurance - $0.217

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds, N.A.

Severance Tax N.A

Rehabilitation Costs N.A.

Laboratory - $0.050

Plant overhead - $0.135

Direct Operating Costs

Production Labor - $0.271

Maintenance Labor - $0.190

Operating Supplies, Powder, Steel - $0.747

Utilities - $0.516

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes - $0.095

Other Fixed Taxes (Severance) N.A

Depreciation - $0.453

Interest N.A.

General Management N.A.

Selling, Marketing N.A

Unnamed
(Ni 1000 Tpd)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TABLE 8. - Predesign financial summary for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Annual throughput (350-day year)....................tons..	35,000	350,000	5,250,000	10,500,000
Total capital investment....................................	$703,000	$2,553,100	$20,765,600	$37,087,800
Depreciation, annual (14-year period)......................	43,700	158,600	1,289,800	2,303,600
Operating cost, annual.....................................	343,200	1,041,000	9,057,000	16,434,000
Operating cost, per ton of throughput......................	9.80	2.97	1.73	1.56
Annual payment to return capital and give 12 percent annual return on total capital investment over a 14-year period..	106,100	385,200	3,132,900	5,595,500
Less depreciation..	43,700	158,600	1,289,800	2,303,600
Equals net income..	62,400	226,600	1,843,100	3,291,900
Taxable income (at 50 percent tax rate = 2 X net income)..	124,800	453,200	3,686,200	6,583,800
Total revenue (taxable income + annual operating cost)..	468,000	1,494,200	12,743,200	22,832,600
Required revenue per ton of throughput....................	13.37	4.27	2.43	2.19

TABLE 9. - Predesign capital cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Estimated delivered equipment (P)........................	$146,800	$529,400	$4,283,000	$7,623,500
Equipment installation (43 percent of P)..................	63,100	227,600	1,841,700	3,278,100
Pipe, installation and insulation (36 percent of P).........	52,800	190,600	1,541,900	2,744,500
Electrical installation (15 percent of P)..................	22,000	79,400	642,400	1,143,500
Buildings including services (35 percent of P).............	51,400	185,300	1,499,100	2,668,200
Yard improvements (10 percent of P).......................	14,700	52,900	428,300	762,400
Service facilities (35 percent of P).......................	51,400	185,300	1,499,100	2,668,200
Land (6 percent of P)......................................	8,800	31,800	257,000	457,400
Total physical cost (PC)................................	411,000	1,482,300	11,992,500	21,345,800
Engineering and construction (20 percent of PC)............	82,200	296,500	2,398,500	4,269,200
Direct plant cost (DPC)..................................	493,200	1,778,800	14,391,000	25,615,000
Cractor's fee (7 percent of DPC).........................	34,500	124,500	1,007,400	1,793,100
tingency (15 percent of DPC)............................	74,000	266,800	2,158,600	3,842,200
Tailings pond site preparation............................	10,000	50,000	500,000	1,000,000
Total estimated fixed capital investment................	611,700	2,220,100	18,057,000	32,250,300
Working capital (15 percent of total fixed capital)........	91,800	333,000	2,708,600	4,837,500
Total estimated capital investment....................	703,500	2,553,100	20,765,600	37,087,800

TABLE 10. - Predesign annual operating cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Direct costs:				
Operating labor..	$75,900	$94,900	$664,300	$854,100
Supervision..	12,000	14,000	35,000	85,400
Maintenance:				
Labor (3 percent of fixed capital)......................	18,400	66,600	541,700	967,500
Supplies (3 percent of fixed capital)...................	18,400	66,600	541,700	967,500
Plant supplies...	23,000	194,900	2,788,600	5,526,900
Utilities..	27,500	180,700	1,115,900	2,274,200
Total direct costs......................................	175,200	617,700	5,687,200	10,675,600
Indirect costs:				
Payroll overhead (27.5 percent of labor cost)............	29,200	48,300	341,300	524,400
Laboratory (10 percent of labor cost)....................	10,600	17,600	124,100	190,700
Plant overhead (50 percent operating labor)..............	37,900	47,400	332,200	427,000
Total indirect costs....................................	77,700	113,300	797,600	1,142,100
Fixed costs:				
Depreciation (fixed capital ÷ 14 years)..................	43,700	158,600	1,289,800	2,303,600
Property taxes (1.5 percent of fixed capital)............	9,200	33,300	270,900	483,800
Insurance (1.25 percent of fixed capital)................	7,600	27,800	225,700	403,100
Total fixed costs.......................................	60,500	219,700	1,786,400	3,190,500
General expense: Administration and research (9.5 percent of direct, indirect, and fixed)............................	29,800	90,300	785,800	1,425,800
Total operating cost....................................	343,200	1,041,000	9,057,000	16,434,000
ting cost per ton of throughput.........................	9.80	2.97	1.73	1.56

rail were based on information given by representatives of the Port of Portland Commission of Public Docks.

Transportation mode, distances, and costs for oxide resources are given in table 20; sulfide resource movements for nickel and copper are given in tables 21 and 22. All transportation between distant points in the contiguous 48 States has been assumed to be by rail. Further evaluation might show, in the case of several resource districts, that transport cost savings could be realized by using water transport through the St. Lawrence Seaway and the Great Lakes.

Cost Summary by District

The cost per pound of recovered nickel for each district is shown in table 23. Added to the mining, milling, and smelting cost is a royalty payment of $0.025 per pound of recoverable nickel to cover property acquisition. Recovery of nickel from sulfide resources is estimated by the equation $Y = \frac{0.4_x + 0.615}{1.35}$, where Y equals the percent of recovery, and X = the grade of the ore in percent. Nickel recovery from oxide ores is based on the smelter slag containing a constant 0.13 percent nickel, which means that as the grade of the material being smelted declines, the percent of nickel recovery also declines. Copper that would be obtained from the nickel sulfide ores as a concentrate is shown in table 24. The value of the copper is established on the basis of 90 percent of the copper being recovered in a 15-percent copper concentrate. Market value is assumed at $0.40 per pound of copper from which is deducted copper-smelter charges and transportation from mill to smelter. The smelter is assumed to pay for 95 percent of the market value ($0.40 per pound) less $0.035 per pound of copper. The net value of the copper is credited to the nickel recovery cost for each deposit (table 23).

Unnamed
(Ni 30,000 tpd)

MILLING COST DATA

Year: 1970

Minerals or Ore: Nickel

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: I C 8469

Type of Ore: Copper-Nickel sulfide ore consisting mainly of peridotite and oxide deposits of nickeliferous laterite, occurring as ①

Type of Mill: Flotation

Products: Ni-Cu Concentrate

Yards or Tons per Day or Shift: 30,000 tons/day

Operators Wages: N.A

No. of Employees: N.A

Type of Crushing & Grinding: N.A

Source of Power: N.A

% Recovery: ②

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton: $0.291

Direct Costs per ton: $1.008

Fixed Costs per ton: $0.265

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $1.564

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① weathering mantles atop serpentine or peridotite

② See attached sheet

Unnamed
(Ni 30,000 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.008

Mine Office, Warehouse - $0.136 (General expense)

Payroll Overhead - Social Security, Insurance - $0.088

Union Welfare, etc., N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Laboratory - $0.018

Plant overhead - $0.041

Direct Operating Costs

Production Labor - $0.081

Maintenance Labor - $0.092

Operating Supplies, Powder, Steel - $0.618

Utilities - $0.217

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes - $0.046

Other Fixed Taxes (Severance) N.A

Depreciation - $0.219

Interest N.A.

General Management N.A

Selling, Marketing N.A

Unnamed
(Ni 30,000 tpd)

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TABLE 8. - Predesign financial summary for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Annual throughput (350-day year)....................tons..	35,000	350,000	5,250,000	10,500,000
Total capital investment................................	$703,000	$2,553,100	$20,765,600	$37,087,800
Depreciation, annual (14-year period)....................	43,700	158,600	1,289,800	2,303,600
Operating cost, annual..................................	343,200	1,041,000	9,057,000	16,434,000
Operating cost, per ton of throughput....................	9.80	2.97	1.73	1.56
Annual payment to return capital and give 12 percent annual return on total capital investment over a 14-year period..	106,100	385,200	3,132,900	5,595,500
Less depreciation.......................................	43,700	158,600	1,289,800	2,303,600
Equals net income.......................................	62,400	226,600	1,843,100	3,291,900
Taxable income (at 50 percent tax rate = 2 × net income)..	124,800	453,200	3,686,200	6,583,800
Total revenue (taxable income + annual operating cost)..	468,000	1,494,200	12,743,200	22,832,600
Required revenue per ton of throughput...................	13.37	4.27	2.43	2.19

TABLE 9. - Predesign capital cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Estimated delivered equipment (P)...........................	$146,800	$529,400	$4,283,000	$7,623,500
Equipment installation (43 percent of P)....................	63,100	227,600	1,841,700	3,278,100
Pipe, installation and insulation (36 percent of P)..........	52,800	190,600	1,541,900	2,744,500
Electrical installation (15 percent of P)....................	22,000	79,400	642,400	1,143,500
Buildings including services (35 percent of P)..............	51,400	185,300	1,499,100	2,668,200
Yard improvements (10 percent of P)..........................	14,700	52,900	428,300	762,400
Service facilities (35 percent of P).........................	51,400	185,300	1,499,100	2,668,200
Land (6 percent of P)..	8,800	31,800	257,000	457,400
Total physical cost (PC)...................................	411,000	1,482,300	11,992,500	21,345,800
Engineering and construction (20 percent of PC).............	82,200	296,500	2,398,500	4,269,200
Direct plant cost (DPC).....................................	493,200	1,778,800	14,391,000	25,615,000
ractor's fee (7 percent of DPC)............................	34,500	124,500	1,007,400	1,793,100
ingency (15 percent of DPC)................................	74,000	266,800	2,158,600	3,842,200
Tailings pond site preparation...............................	10,000	50,000	500,000	1,000,000
Total estimated fixed capital investment....................	611,700	2,220,100	18,057,000	32,250,300
Working capital (15 percent of total fixed capital).........	91,800	333,000	2,708,600	4,837,500
Total estimated capital investment.........................	703,500	2,553,100	20,765,600	37,087,800

TABLE 10. - Predesign annual operating cost estimate for copper-nickel sulfide flotation mill

	100 tpd mill	1,000 tpd mill	15,000 tpd mill	30,000 tpd mill
Direct costs:				
Operating labor...	$75,900	$94,900	$664,300	$854,100
Supervision...	12,000	14,000	35,000	85,400
Maintenance:				
Labor (3 percent of fixed capital)........................	18,400	66,600	541,700	967,500
Supplies (3 percent of fixed capital).....................	18,400	66,600	541,700	967,500
Plant supplies..	23,000	194,900	2,788,600	5,526,900
Utilities...	27,500	180,700	1,115,900	2,274,200
Total direct costs..	175,200	617,700	5,687,200	10,675,600
Indirect costs:				
Payroll overhead (27.5 percent of labor cost).............	29,200	48,300	341,30	524,400
Laboratory (10 percent of labor cost).....................	10,600	17,600	124,1	190,700
Plant overhead (50 percent operating labor)...............	37,900	47,400	332	427,000
Total indirect costs......................................	77,700	113,300	797	142,100
Fixed costs:				
Depreciation (fixed capital ÷ 14 years)...................	43,700	158,600	1,289	303,600
Property taxes (1.5 percent of fixed capital).............	9,200	33,300	270,	483,800
Insurance (1.25 percent of fixed capital).................	7,600	27,800	225,	403,100
Total fixed costs...	60,500	219,700	1,786,40	,190,500
General expense: Administration and research (9.5 percent of direct, indirect, and fixed)....................	29,800	90,300	785,800	,425,800
Total operating cost......................................	343,200	1,041,000	9,057,000	1[illegible],434,000
ting cost per ton of throughput............................	9.80	2.97	1.73	1.56

rail were based on information given by representatives of the Port of Portland Commission of Public Docks.

Transportation mode, distances, and costs for oxide resources are given in table 20; sulfide resource movements for nickel and copper are given in tables 21 and 22. All transportation between distant points in the contiguous 48 States has been assumed to be by rail. Further evaluation might show, in the case of several resource districts, that transport cost savings could be realized by using water transport through the St. Lawrence Seaway and the Great Lakes.

Cost Summary by District

The cost per pound of recovered nickel for each district is shown in table 23. Added to the mining, milling, and smelting cost is a royalty payment of $0.025 per pound of recoverable nickel to cover property acquisition. Recovery of nickel from sulfide resources is estimated by the equation $Y = \frac{0.4_x + 0.615}{1.35}$, where Y equals the percent of recovery, and X = the grade of the ore in percent. Nickel recovery from oxide ores is based on the smelter slag containing a constant 0.13 percent nickel, which means that as the grade of the material being smelted declines, the percent of nickel recovery also declines. Copper that would be obtained from the nickel sulfide ores as a concentrate is shown in table 24. The value of the copper is established on the basis of 90 percent of the copper being recovered in a 15-percent copper concentrate. Market value is assumed at $0.40 per pound of copper from which is deducted copper-smelter charges and transportation from mill to smelter. The smelter is assumed to pay for 95 percent of the market value ($0.40 per pound) less $0.035 per pound of copper. The net value of the copper is credited to the nickel recovery cost for each deposit (table 23).

QUARTZITE

Honey Brook

MILLING COST DATA

Year: 1964

Minerals or Ore: Quartzite

State: Pennsylvania

District or County: Lancaster County

Mill: Honey Brook Plant

Owner or Operator: George F. Pettinos, Inc

Source of Information: I.C. 8248

Type of Ore: The Chickies member is quartzite interlayered sericitic quartz schist. The rock ranges from a thin-bedded, ①

Type of Mill: Open pit

Products: Ground quartz (amorphous silica

Yards or Tons per Day or Shift: 40 tons per hour.

Operators Wages: N.A.

No. of Employees: N.A.

Type of Crushing & Grinding: ②

Source of Power: Pennsylvania Power & Light Co.

% Recovery: N.A.

Distance to Smelter: N.A

Water Source: Well water

How Shipped: N.A

Indirect Costs per ton: . . . . 19.02 % of TC

Direct Costs per ton: . . . . 39.90 % of TC

Fixed Costs per ton: . . . . 30.08 % of TC

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . 89.00% of TC

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

Preparation for mining - 3.00% of Total Cost

Mining - 8.00 % of Total Cost

over ↓

fine-grained quartzite with sericitic partings in the upper part to a thick bedded, light bluish vitreous quartzite in the lower part.

The Hellam member of the formation is a coarse-grained quartzite with scattered, round quartz pebbles and conglomerate beds with interbedded black slate.

② 15"X24" Jaw crusher (3½" set)

↓

3' Cone crusher (½" set)

↓

8' Pan mill

Honey Brook

Indirect Costs

Labor, Management, Supervision, Clerical - 4.20 % of TC

Mine Office, Warehouse - 6.00 % of TC

Payroll Overhead - Social Security, Insurance - 3.70% of TC

Union Welfare, etc. N.A

Medical and Life Insurance - 0.30 % of TC (insurance)

Royalties - 2.30% of TC

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Vacation and Holiday pay - 2.10% of TC | Miscellaneous 0.4% of TC

Storage - 0.02% of TC

Direct Operating Costs

Production Labor - 11.40 % of TC

Maintenance Labor - 9.00% of TC

Operating Supplies, Powder, Steel - 2.08% of TC

Utilities - 7.00 % of TC

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment - 10.42 % of TC

Fixed Costs

Property Taxes } 0.08% of TC (Taxes)

Other Fixed Taxes (~~Severance~~) }

Depreciation - 30.00% of TC

Interest N.A

General Management N.A

Selling, Marketing N.A

Honey Brook

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

RHENIUM

Unnamed
Re

MILLING COST DATA

Year: 1970

Minerals or Ore: Rhenium

State: Arizona - New Mexico

District or County: N.A

Economic Availability Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8573

Type of Ore: Rhenium is found enriched in the molybdenite of porphyry-copper deposits (0.2-0.5% MoS_2), (0.00001% Re)

Type of Mill: Roasting and crystallization

Products: Ammonium Perrhenate (NH_4ReO_4)

Yards or Tons per Day or Shift: 23,529 tons/day

Operators Wages: $44.00/shift

No. of Employees: 13

Type of Crushing & Grinding: N.A.

Source of Power: N.A.

% Recovery: ≈50%

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ~~ton~~: . . . . $22.38/lb Re

Direct Costs per ~~ton~~: . . . . $90.71/lb Re

Fixed Costs per ~~ton~~: . . . . N.A.

Capitalization Costs per ~~ton~~: . . . . N.A.

Rehabilitation Costs per ~~ton~~: . . . . N.A.

Total Milling costs per ~~ton~~: . . . . $113.09/lb Re

Shipping costs per ~~ton~~: . . . . N.A.

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:

Rhenium price (1971) - $875.00/lb

Unnamed
Re

Indirect Costs

Labor, Management, Supervision, Clerical - $8.00/lb Re
Mine Office, Warehouse - $14.38/lb Re (General overhead)
Payroll Overhead - Social Security, Insurance N.A.
Union Welfare, etc. N.A.
Medical and Life Insurance N.A
Royalties N.A
Pension Funds N.A
Severance Tax N.A
Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $29.05/lb Re
Maintenance Labor - $10.89/lb Re
Operating Supplies, Powder, Steel - $14.16/lb Re
Utilities - $20.42/lb Re
Transportation Mine to Mill N.A.
Freight, Supplies Delivered N.A
Future Development Costs N.A.
Maintenance and Service of Equipment N.A.
Reagents and chemicals - $16.19/lb Re

Fixed Costs N.A

Property Taxes
Other Fixed Taxes (Severance)
Depreciation
Interest
General Management
Selling, Marketing

Unnamed
Re

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

RUTILE {Heavy Minerals}

Heavy Mineral
Fractionation

MILLING COST DATA

Minerals or Ore: Heavy Minerals (Rutile) **Year:** 1972

State: Southeastern United States

District or County: N.A

Mineral Availability Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8540

Type of Ore:
Sand

Type of Mill: Heavy mineral fractionation

Yards or Tons per Day or Shift:
273 tons/day processed

No. of Employees: 25

Source of Power: N.A.

Distance to Smelter: N.A.

How Shipped: N.A

Products: Heavy mineral component

Operators Wages: N.A.

Type of Crushing & Grinding: N.A

% Recovery: N.A

Water Source: N.A

Indirect Costs per ton: $1.42

Direct Costs per ton: $3.57

Fixed Costs per ton: $1.39

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $6.38

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

Heavy Minerals
Fractionation

Indirect Costs

Labor, Management, Supervision, Clerical N.A.

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $0.92

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Indirect costs - $0.50

Direct Operating Costs

Production Labor }
Maintenance Labor } $2.64 (Total labor and supervision)

Operating Supplies, Powder, Steel - $0.68

Utilities - $0.25

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes }
Other Fixed Taxes (~~Severance~~) } $0.39 (Taxes and insurance

Depreciation - $1.00

Interest N.A

General Management N.A

Selling, Marketing N.A

Heavy Minerals
Fractionation

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Total Capital Requirements - $1,932,500
(including $130,000 working capital)

Heavy Minerals
Benification

MILLING COST DATA

Minerals or Ore: Heavy Minerals (Rutile) **Year:** 1972

State: Southeastern United States

District or County: N.A.

Mineral Availability Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8540

Type of Ore:
Sand

Type of Mill: Gravity - Beneficiation

Yards or Tons per Day or Shift:
1250 Tons / day

No. of Employees: N.A

Source of Power: N.A

Distance to Smelter: N.A.

How Shipped: N.A.

Products: Titanium Concentrate

Operators Wages: $3.50/hr

Type of Crushing & Grinding: N.A

% Recovery: N.A

Water Source: N.A

Indirect Costs per ton: $0.037

Direct Costs per ton: $0.069

Fixed Costs per ton: $0.064

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $0.170

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks: N.A
Sand feed; -10 mesh

Heavy Minerals
Beneficiation

Indirect Costs

Labor, Management, Supervision, Clerical - $0.008

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $0.020

Union Welfare, etc. N.A.

Medical and Life Insurance (included in fixed costs)

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Indirect Costs - $0.009

Direct Operating Costs

Production Labor - $0.034

Maintenance Labor - $0.017

Operating Supplies, Powder, Steel - $0.010

Utilities - $0.008

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.014 (Taxes and insurance)

Depreciation — $0.050

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Heavy Minerals
Benefication

Capital Costs

- Working Capital
- Purchase Cost
- Capitalization of Exploration and Development
- Roads and other local construction
- Capitalization of Equipment
- Capitalization of Plant

Total capital requirement - $227,000
(including $9,100 working capital)

SILVER

Emperius

MILLING COST DATA

Year: 1965

Minerals or Ore: Silver

State: Colorado

District or County: Mineral County

Mill: Emperius Mining Co. Mill

Owner or Operator: Emperius Mining Co

Source of Information: IC 8370

Type of Ore:
Mineralization occurs in highly brecciated fault fractures in a series of volcanic flow rocks (rhyolites) ①

Type of Mill: Flotation

Yards or Tons per Day or Shift: 200 tons/day

No. of Employees: N.A

Source of Power: N.A

Distance to Smelter: N.A.

How Shipped: N.A.

Products: Pb, Zn concentrates containing gold, silver and copper

Operators Wages: N.A.

Type of Crushing & Grinding: ②

% Recovery: ③

Water Source:
Pumped from Nelson Tunnel

Indirect Costs per ton: $0.208

Direct Costs per ton: $4.938

Fixed Costs per ton: $0.962

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $6.108

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings:

Remarks:
Data also available for 1942, 1947, 1949, 1950-1964.

① Ore minerals include: Angelsite, Chalcopyrite, Chrysocolla, Galena, Pyrite, and Sphalerite. Gangue minerals include: Calcite, Hematite Marcasite, Quartz and others.

② Primary Jaw Crusher
↓
Cone Crusher (2")
↓
Ball Mill (6'X6')

③

	Au	Ag	Cu	Pb	Zn
Lead Concentrate	67.4	79.3	85.8	80.1	9.3
Zinc Concentrate	8.9	8.1	5.7	3.0	80.2
Tailings	23.7	12.6	8.5	16.9	10.5

Emperius

Indirect Costs

Labor, Management, Supervision, Clerical N.A.

Mine Office, Warehouse – $0.074 (overhead)

Payroll Overhead - Social Security, Insurance – $0.134

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor
Maintenance Labor
} $2.533 (Salaries and wages)

Operating Supplies, Powder, Steel – $1.827

Utilities – $0.453

Transportation Mine to Mill – $0.051

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A.

Assays - $0.074

Fixed Costs

Property Taxes N.A.

Other Fixed Taxes (~~Severance~~) – $0.211 (insurance and taxes)

Depreciation – $0.660

Interest – $0.091

General Management N.A.

Selling, Marketing N.A.

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

London - Butte

MILLING COST DATA

Minerals or Ore: Gold, Silver, Lead

Year: 1937

State: Colorado

District or County: Park County

Mill: London-Butte Gold Mine Mill

Owner or Operator: London Butte Gold Mines Co

Source of Information: I C 7101

Type of Ore:
The quartz [illegible] [illegible] of a glassy, milky variety.
[illegible] addition to free gold, the [illegible] contain pyrite &

Type of Mill: Gravity Flotation

Products: [illegible] silver, lead [illegible]

Yards or Tons per Day or Shift: 200 tons/day [illegible]

Operators Wages: $4.65 - $5.75/shift

No. of Employees: 10

Type of Crushing & Grinding: ②

Source of Power: Public Service Co. of Colorado.

% Recovery: 92.79% for gold

Distance to Smelter: 80 miles

Water Source: The mine

How Shipped: Truck

Indirect Costs per ton: $0.143

Direct Costs per ton: $1.473

Fixed Costs per ton: . . . . N.A.

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $1.616

Shipping costs per ton: . . . . $4.50 - $5.50

Method of Tailings Disposal: Tailings dam

Method of Rehabilitation of Tailings:

Remarks:

over ↓

① galena, chalcopyrite, sphalerite, and fragments of shale and porphyry. A limestone formation contains nearly all the silver-lead replacement deposits.

② Oversize ore broken with hammers
↓
10"x16" jaw crusher set at 1½"
↓
2' cone crusher set at $\frac{3}{8}$"
↓
6'x6' cylindrical ball mill

London-Butte

Indirect Costs

Labor, Management, Supervision, Clerical - $0.106

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance - $0.024

Union Welfare, etc. N.A

Medical and Life Insurance $0.013

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $0.510

Maintenance Labor - $0.088

Operating Supplies, Powder, Steel $0.256

Utilities - $0.404

Transportation Mine to Mill N.A

Freight, Supplies Delivered - $0.059

Future Development Costs N.A

Maintenance and Service of Equipment - $0.048

Assays - $0.084

Miscellaneous - $0.020

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

London-Butte

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Yellow Pine

MILLING COST DATA

Minerals or Ore: Gold, Silver, Antimony **Year:** 1940

State: Idaho

District or County: Valley County

Mill: Yellow Pine concentrator

Owner or Operator: Bradley Mining Co.

Source of Information: IC 7194

Type of Ore:
Pyrite and arsenopyrite disseminated through more or less altered granodiorite - aplite country rock Stibn

Type of Mill: Flotation

Products: gold silver concentrate

Yards or Tons per Day or Shift:
14,000 tons/month

Operators Wages: N.A.

No. of Employees: N.A

Type of Crushing & Grinding: (2)

Source of Power:
Hydroelectric plant, [illegible]

% Recovery:
mill recovery 70%, economic recovery 61

Distance to Smelter:
approximately [illegible] m

Water Source: (3)

How Shipped:
Truck then railroad

Indirect Costs per ton: . . . . N.A

Direct Costs per ton: $0.1850

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $0.1858

Shipping costs per ton: . . . . $9 - $10

Method of Tailings Disposal: tailings pond

Method of Rehabilitation of Tailings: N.A

Remarks:

① occurs on the west side of the ore zone disseminated through the ore and in high-grade stringers

② 24" X 36" Blake-type jaw crusher.
↓
No. 5 Gates gyratory crusher
↓
3-foot Symons cone crusher
↓
8' x 3' and 8' x 4' Hardinge ball mill

③ Mill water is from a dam on the South Fork of Meadow Creek. Water for power comes from Meadow creek and its South Fork and from the East Fork of the South Fork of the Salmon River

Yellow Pine

Indirect Costs N.A

Labor, Management, Supervision, Clerical

Mine Office, Warehouse

Payroll Overhead - Social Security, Insurance

Union Welfare, etc.

Medical and Life Insurance

Royalties

Pension Funds

Severance Tax

Rehabilitation Costs

Direct Operating Costs

Production Labor } $0.2740 (labor)

Maintenance Labor }

Operating Supplies, Powder, Steel – $0.2895

Utilities

Transportation Mine to Mill

Freight, Supplies Delivered

Future Development Costs

Maintenance and Service of Equipment

Miscellaneous - $0.2215

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Yellow Pine

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TALC

Johnson

MILLING COST DATA

Year: 1959

Minerals or Ore: Talc

State: Vermont

District or County: Johnson Township

Mill: Johnson Mine Mill

Owner or Operator: Eastern Magnesia Talc Co.

Source of Information: IC 8142

Type of Ore: Mixed talc and magnesite (grit). Also talc with relatively few masses of serpentine

Type of Mill: Air classification and flotation

Products: 14 grades of talc

Yards or Tons per Day or Shift: 220 tons/day

Operators Wages: $1.576/hr

No. of Employees: 26

Type of Crushing & Grinding: Jaw crusher, pebble mill

Source of Power: Morrisville Power and Light Co

% Recovery: 47.34%

Distance to Smelter: N.A.

Water Source: N.A.

How Shipped: 60% railroad, 40% truck

Indirect Costs per ton: . . . . N.A

Direct Costs per ton: $1.3478

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $1.3478

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: Tailings Pond

Method of Rehabilitation of Tailings: N.A

Remarks:

Milling is 54.77% of Total Cost

Johnson

Indirect Costs N.A

Labor, Management, Supervision, Clerical

Mine Office, Warehouse

Payroll Overhead - Social Security, Insurance

Union Welfare, etc.

Medical and Life Insurance

Royalties

Pension Funds

Severance Tax

Rehabilitation Costs

Direct Operating Costs

Production Labor N.A

Maintenance Labor N.A

Operating Supplies, Powder, Steel — $0.055

Utilities — 95.00 kwhrs/ton

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Grinding and drying - $1.2928

Fixed Costs N.A.

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Johnson

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TANTALITE

Black Hills

MILLING COST DATA

Minerals or Ore: Tin ([illegible] tantalite) **Year:** 1938

State: South Dakota

District or County:

Mill: Black Hills Tin Co.

Owner or Operator: Fansteel Metallurgical Corp

Source of Information: IC 7084

Type of Ore:
Tantalite in pegmatite

Type of Mill: Concentrating table

Yards or Tons per Day or Shift:
32 tons/day (milled)

No. of Employees: 5

Source of Power:
Diesel power unit on site

Distance to Smelter: N.A

How Shipped: N.A

Products: Tantalum Concentrate

Operators Wages:
$2 - $6/shift

Type of Crushing & Grinding:
①

% Recovery: N.A

Water Source:
Pumped from sump in Mallory Gulch

Indirect Costs per ton:	$0.185
Direct Costs per ton:	$0.792
Fixed Costs per ton:	N.A
Capitalization Costs per ton:	N.A
Rehabilitation Costs per ton:	N.A
Total Milling costs per ton:	$0.977
Shipping costs per ton:	N.A

Method of Tailings Disposal: brush dams and a large earth dam

Method of Rehabilitation of Tailings: N.A

Remarks:

① Gyratory crusher set at 2"
↓
Cone crusher set at ¼"
↓
rolls

Black Hills

Indirect Costs

Labor, Management, Supervision, Clerical } $0.185
Mine Office, Warehouse }

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor – $0.417

Maintenance Labor – $0.100

Operating Supplies, Powder, Steel - $0.068

Utilities – $0.207

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

DICK MILLS

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TIN

MILLING COST DATA

Year: 1954

Minerals or Ore: Tin

State: Alaska

District or County: Nome Burrough

Mill: United States Tin Corp. mill

Owner or Operator: United States Tin Corp.

Source of Information: IC 7871

Type of Ore: Vein-like or dike deposits. The main ore minerals are cassiterite and wolframite. Nonmetallic gangue①

Type of Mill: Gravity and flotation

Yards or Tons per Day or Shift: N.A

No. of Employees: N.A.

Source of Power: Diesel Power Plant

Distance to Smelter: ③

How Shipped: N.A

Products: Tin concentrate

Operators Wages: $2.00/hr

Type of Crushing & Grinding: ②

% Recovery: 54.5% overall

Water Source: subsurface water flow

Indirect Costs per ton: $0.76

Direct Costs per ton: $4.27

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $5.03

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A.

Remarks:

over ↓

minerals include: quartz, fluorite, topaz, tourmaline, zinnwaldite, clay minerals and lime-magnesium silicates.

② 10"x20" Pacific jaw crusher
↓
Acme Road-Machinery crusher
↓
4'x5' Union Iron Works ball mill

③ Concentrate is shipped to Texas City Texas for refining. The mode of transportation is not mentioned

U.S. Tin

Indirect Costs

Labor, Management, Supervision, Clerical - $0.76

Mine Office, Warehouse N.A.

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor } $1.48

Maintenance Labor }

Operating Supplies, Powder, Steel - $0.60

Utilities — $1.65

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment - $0.54

Fixed Costs N.A

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

V.S. 11n

Capital Costs N.A

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

TUNGSTEN

Unnamed
(300 tpd)

MILLING COST DATA

Year: 1971

Minerals or Ore: Tungsten

State: N.A.

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8500

Type of Ore:
Tactite deposit. The ore occurs in tactite along the contact of granite and limestone. The ore mineral is ①

Type of Mill:

Yards or Tons per Day or Shift: 300 tons/day

Products: Tungsten concentrate to market

No. of Employees: 14

Operators Wages: $3.00-$3.50

Type of Crushing & Grinding: ②

Source of Power: N.A.

% Recovery: 90%

Distance to Smelter: N.A.

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: $1.41

Direct Costs per ton: $2.93

Fixed Costs per ton: $1.37

Capitalization Costs per ton: $1.23

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $6.94

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

Cost projections for a 300 tpd mill

over↓

① scheelite, a calcium tungstate. Dip of 75°. The ore averages 1.0% WO_3.

② jaw crusher (15"x24", 4"set)
↓
cone crusher (3', ¾"set)
↓
rod mill (5'x8')
↓
ball mill (5'x6')

Unnamed
(300 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.41

Mine Office, Warehouse - $0.50 (Administration and general overhead)

Payroll Overhead - Social Security, Insurance

Union Welfare, etc. - $0.50 (fringe benefits)

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $0.87

Maintenance Labor - $0.28

Operating Supplies, Powder, Steel - $1.28

Utilities - $0.23

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment - $0.27

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.14 (taxes and insurance)

Depreciation - $1.23 (depreciation and deferred expenses)

Interest N.A

General Management N.A

Selling, Marketing N.A

Unnamed
(300 tpd)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

$$\frac{\$132{,}300/\text{yr}}{108{,}000\ \text{tons/yr}} = \$1.23/\text{ton}$$

Unnamed
(200 tpd)

MILLING COST DATA

Year: 1971

Minerals or Ore: Tungsten

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8500

Type of Ore:
Tactite deposit. The ore mineral is scheelite, a calcium tungstate. Associated with it is powellite, a calcium ①

Type of Mill: Flotation & tabling

Products: ②

Yards or Tons per Day or Shift: 200 tons/day

Operators Wages: $3.00 - $3.50

No. of Employees: 12

Type of Crushing & Grinding: ③

Source of Power: N.A

% Recovery: 90%

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A

Indirect Costs per ton:	$1.63
Direct Costs per ton:	$3.43
Fixed Costs per ton:	$1.93
Capitalization Costs per ton:	$1.76
Rehabilitation Costs per ton:	N.A
Total Milling costs per ton:	$8.75
Shipping costs per ton:	N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:

Cost projections for a 200 tpd mill

over ↓

① molybdate. 20°-30° dip. Averages 0.39% WO_3

② Tungsten concentrate to market
Tungsten concentrate to chemical plant

③ Jaw Crusher (21" x 36", 3" set)
↓
Cone crusher (3')
↓
Ball Mill (6' x 6')

Unnamed
(200 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.44

Mine Office, Warehouse - $0.58 (Administration & general overhead)

Payroll Overhead - Social Security, Insurance

Union Welfare, etc. - $0.61 (fringe benefits)

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $1.22

Maintenance Labor - $0.38

Operating Supplies, Powder, Steel - $1.30

Utilities - $0.29

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment - $0.24

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.17 (taxes and insurance)

Depreciation - $1.76 (Depreciation & deferred expenses)

Interest N.A.

General Management N.A

Selling, Marketing N.A

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

$$\frac{\$123{,}300/\text{yr}}{70{,}000\ \text{tons}/\text{yr}} = \$1.76/\text{ton}$$

Unnamed
(125 tpd)

MILLING COST DATA

Year: 1971

Minerals or Ore: Tungsten

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8500

Type of Ore:
Two ore bodies occur in tactite along a contact of granite and limestone. Scheelite, a calcium ①

Type of Mill: Flotation and table concentration

Products: ③

Yards or Tons per Day or Shift: 125 tons/day

Operators Wages: $3.00 - $3.50

No. of Employees: 12

Type of Crushing & Grinding: ②

Source of Power: N.A

% Recovery: 90%

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton: $3.40

Direct Costs per ton: $6.28

Fixed Costs per ton: $6.32

Capitalization Costs per ton: $2.68

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $18.68

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A.

Remarks:

Cost projections for a 125 ton/day mill

over ↓

① Tungsiate, is a chief ore mineral. Dip is about 60° to the east.

② jaw crusher (15"x24", 3"set)
↓
cone crusher (24", size reduction to ½")
↓
Ball Mill (5'x5')

③ Tungsten concentrate - to market
Garnet - to chemical plant
Scheelite - to market

Unnamed
(125 tpd)

Indirect Costs

Labor, Management, Supervision, Clerical – $1.12

Mine Office, Warehouse – $1.11 (Administration & general overhead)

Payroll Overhead - Social Security, Insurance N.A.

Union Welfare, etc. – $1.17 (fringe benefits)

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor – $1.75

Maintenance Labor – $0.70

Operating Supplies, Powder, Steel – $2.67

Utilities – $0.38

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment – $0.78

Fixed Costs

Property Taxes

Other Fixed Taxes (Severance) } $0.34 (taxes and insurance)

Depreciation – $5.98 (depreciation and deferred expense)

Interest N.A

General Management N.A.

Selling, Marketing N.A.

Unnamed
(125 tpd)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

$$\frac{\$100{,}600/yr}{37{,}500\ tons/yr} = \$2.68/ton$$

Unnamed
(50 Tpd)

MILLING COST DATA

Year: 1971

Minerals or Ore: Tungsten

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8500

Type of Ore:
A tungsten-bearing quartz vein in granite and metamorphic rocks. The vein consists of quartz and ferberite, ①

Type of Mill: Jig & Table Concentration

Products: Tungsten concentrate

Yards or Tons per Day or Shift: 50 tons/day

Operators Wages: $3.00-$3.50/hr

No. of Employees: 9

Type of Crushing & Grinding: ②

Source of Power: N.A

% Recovery: 85%

Distance to Smelter: N.A

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton: $3.24

Direct Costs per ton: $5.97

Fixed Costs per ton: $6.32

Capitalization Costs per ton: $5.98

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $21.51

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A.

Remarks:

Cost projections for a 50 ton/day mill

over ↓

① a tungstate of iron

② Jaw Crusher (10"x20", 1" setting)
↓
Crushing rolls (20"x12")
↓
Rod mill (3'x9')

Unnamed
(50tpd)

Indirect Costs

Labor, Management, Supervision, Clerical – $0.73

Mine Office, Warehouse – $1.00 (Administration & general overhead)

Payroll Overhead - Social Security, Insurance

Union Welfare, etc. – $1.51 (fringe benefits)

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor – $4.04

Maintenance Labor – $0.56

Operating Supplies, Powder, Steel – $0.91

Utilities – $0.19

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment – $0.27

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.34 (taxes and insurance)

Depreciation – $5.98 (depreciation and deferred expense)

Interest N.A

General Management N.A

Selling, Marketing N.A

Unnamed
(50 tpd)

Capital Costs

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Capital cost:

$$\frac{\$89{,}700/\text{yr}}{15{,}000\ \text{tons/yr}} = \$5.98/\text{ton}$$

URANIUM

Unnamed
(200,000 lb U_3O_8/yr)
(phosphate rock

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8)

Year: 1971

State: N.A.

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC8501

Type of Ore:
Phosphate rock is washed, concentrated, then leached with sulfuric acid. The resulting phosphoric acid (25%-30% P_2O_5) ①

Type of Mill: Solvent extraction

Products: U_3O_8

Yards or Tons per Day or Shift:
200,000 lb U_3O_8/yr produced

Operators Wages: $3.34/hr

No. of Employees:
15/day (excluding supervision)

Type of Crushing & Grinding: N.A.

Source of Power: N.A.

% Recovery: 90%

Distance to Smelter: N.A.

Water Source: N.A.

How Shipped: N.A.

Indirect Costs per ton: . . . . $1.31 /lb U_3O_8

Direct Costs per ton: . . . . $5.93 /lb U_3O_8

Fixed Costs per ton: . . . . $2.01/lb U_3O_8

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . $9.25/lb U_3O_8

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:
Cost analysis of recovering uranium from wet-process phosphoric acid. Technology of the 1953-1961 period was used

① from acidulation contains from 90 to 200 milligrams per liter.

Unnamed
(200,000 lb U_3O_8/yr)
(phosphate rock)

Indirect Costs

Labor, Management, Supervision, Clerical -$0.19/lb

Mine Office, Warehouse -$0.78/lb (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.34/lb

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $0.73/lb

Maintenance Labor - $0.42/lb

Operating Supplies, Powder, Steel - $428/lb

Utilities - $0.50/lb

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A.

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.32 (taxes and insurance)

Depreciation - $1.69

Interest N.A.

General Management N.A

Selling, Marketing N.A

Unnamed
(200,000 lb U_3O_8/yr)
(phosphate rock)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(16,000 gpm)

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8)

Year: 1971

State: N.A.

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8501

Type of Ore: 6ppm U_3O_8 in copper leach solution after copper precipitation has taken place

Type of Mill: Ion exchange resin and solvent extraction ①

Yards or Tons per Day or Shift: 16,000 gpm

No. of Employees: 6/shift

Source of Power: N.A.

Distance to Smelter: N.A

How Shipped: N.A

Products: U_3O_8

Operators Wages: $3.25/hr.

Type of Crushing & Grinding: leach solution after copper precipitation

% Recovery: 90%

Water Source: N.A.

Indirect Costs per ton: . . . . $0.312/lb U_3O_8

Direct Costs per ton: . . . . $1.046/lb U_3O_8

Fixed Costs per ton: . . . . $0.448/lb U_3O_8

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . $1.806/lb U_3O_8

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A.

Remarks:

Cost analysis of recovering U_3O_8 from copper leach solution. over↓

① of liquid exchange

Unnamed
(16,000 gpm)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.045/lb

Mine Office, Warehouse - $0.183/lb (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.084/lb

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $0.250/lb

Maintenance Labor - $0.041/lb

Operating Supplies, Powder, Steel - $0.625/lb

Utilities - $0.130/lb

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A

Maintenance and Service of Equipment N.A.

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.124/lb. (taxes and insurance)

Depreciation - $0.324/lb

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Unnamed
(16,000 gpm)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(2000 gpm)

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8) **Year:** 1971

State: N.A

District or County: N.A

Mill: Unnamed Mineral Supply Study

Owner or Operator: N.A

Source of Information: IC 8501

Type of Ore:
6ppm U_3O_8 in copper leach solution after copper precipitation has taken place.

Type of Mill: ion exchanger resin and solvent extraction of ①

Yards or Tons per Day or Shift: 2,000 gpm

Products: U_3O_8

No. of Employees: 6/shift

Operators Wages: $3.25/hr.

Source of Power: N.A.

Type of Crushing & Grinding: leach solution after copper precipitation

Distance to Smelter: N.A.

% Recovery: 90%

How Shipped: N.A

Water Source: N.A.

Indirect Costs per ~~ton~~:	$2.226/lb U_3O_8
Direct Costs per ~~ton~~:	$3.330/lb U_3O_8
Fixed Costs per ~~ton~~:	$0.644/lb U_3O_8
Capitalization Costs per ~~ton~~:	N.A
Rehabilitation Costs per ~~ton~~:	N.A
Total Milling costs per ~~ton~~:	$6.200/lb U_3O_8
Shipping costs per ~~ton~~:	N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:
Cost analysis of recovering U_3O_8 from copper leach solution. over↓

Unmined
(3,000 gpm)

① liquid exchange

Indirect Costs

Labor, Management, Supervision, Clerical - $0.365/lb

[illegible] - $1.187/lb (administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.674/lb

Union Welfare, etc. N/A

Medical and Life Insurance N/A

Royalties N/A

Pension Funds N/A

Severance Tax N/A

Rehabilitation Costs N/A

Direct Operating Costs

Production Labor - $2.08/lb

Maintenance Labor - $0.328/lb

Operating Supplies, Powder, Steel - $0.784/lb

Utilities - $0.218/lb

Transportation Mine to Mill N/A

Freight, Supplies Delivered N/A

Future Development Costs N/A

Maintenance and Service of Equipment N/A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.178 (taxes and insurance)

Depreciation - $0.466

Interest N/A

General Management N/A

Selling, Marketing N/A

Unnamed
(2000 gpm)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.365/lb

Mine Office, Warehouse - $1.187/lb (administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.674/lb

Union Welfare, etc. N.A

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $2.00/lb

Maintenance Labor - $0.328/lb

Operating Supplies, Powder, Steel - $0.784/lb

Utilities - $0.218/lb

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment N.A.

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.178 (taxes and insurance)

Depreciation - $0.466

Interest N.A.

General Management N.A

Selling, Marketing N.A.

unnamed
(2000gpm)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(4,000 gpm)

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8)

Year: 1971

State: N.A

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8501

Type of Ore:
6ppm U_3O_8 in copper leach solution after copper precipitation has taken place

Type of Mill: ion exchange resin and solvent extraction of ①

Products: U_3O_8

Yards or Tons per Day or Shift: 4,000 gpm

Operators Wages: $3.25/hr.

No. of Employees: 6/shift

Type of Crushing & Grinding: leach solution after copper precipitation

Source of Power: N.A

% Recovery: 90%

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A

Indirect Costs per ~~ton~~: . . . . $1.135/lb U_3O_8

Direct Costs per ~~ton~~: . . . . $2.038/lb U_3O_8

Fixed Costs per ~~ton~~: . . . . $0.543/lb U_3O_8

Capitalization Costs per ~~ton~~: . . . . N.A

Rehabilitation Costs per ~~ton~~: . . . . N.A

Total Milling costs per ~~ton~~: . . . . $3.716/lb U_3O_8

Shipping costs per ~~ton~~: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A

Remarks:
cost analysis of recovering U_3O_8 from copper leach solution.

over ↓

① liquid exchange.

Unnamed
(4,000 gpm)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.183/lb

Mine Office, Warehouse - $0.615/lb (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.337

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $1.00/lb

Maintenance Labor - $0.164/lb

Operating Supplies, Powder, Steel $0.696/lb

Utilities - $0.178/lb.

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.150/lb. (taxes and insurance)

Depreciation - $0.393/lb.

Interest N.A

General Management N.A.

Selling, Marketing N.A

Unnamed
(4,000 gpm)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(8,000 gpm)

MILLING COST DATA

Year: 1971

Minerals or Ore: Uranium (U_3O_8)

State: N.A

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A

Source of Information: IC 8501

Type of Ore:
6 ppm U_3O_8 in copper leach solution after copper precipitation has taken place.

Type of Mill: ion exchange resin and solvent extraction of ①

Products: U_3O_8

Yards or Tons per Day or Shift: 8,000 gpm

Operators Wages: $3.25/hr.

No. of Employees: 6/shift

Type of Crushing & Grinding: leach solution after copper precipitation

Source of Power: N.A

% Recovery: 90%

Distance to Smelter: N.A.

Water Source: N.A

How Shipped: N.A.

Indirect Costs per ton: . . . . $0.588/lb U_3O_8

Direct Costs per ton: . . . . $1.382/lb U_3O_8

Fixed Costs per ton: . . . . $0.485/lb U_3O_8

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . $2.455/lb U_3O_8

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A.

Remarks:
Cost analysis of recovering U_3O_8 from copper leach solution.

Unnamed
(8,000 gpm)

Indirect Costs

Labor, Management, Supervision, Clerical - $0.051

Mine Office, Warehouse - $0.323/lb. (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.169

Union Welfare, etc. N.A.

Medical and Life Insurance N.A

① liquid exchange

Royalties N.A.

Pumping Bonds N.A

Severance Tax N.A

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $0.500

Maintenance Labor - $0.082

Operating Supplies, Powder, Steel - $0.652

Utilities - $0.148

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes } $0.134 (Taxes and insurance)
Other Fixed Costs (Insurance) }

Depreciation - $0.351

Interest N.A.

General Management N.A.

Unnamed
(8,000 gpm)

Indirect Costs

Labor, Management, Supervision, Clerical -$0.091

Mine Office, Warehouse -$0.328/lb. (Administration and general overhead)

Payroll Overhead - Social Security, Insurance -$0.169

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $0.500

Maintenance Labor - $0.082

Operating Supplies, Powder, Steel - $0.652

Utilities - $0.148

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.134 (taxes and insurance)

Depreciation -$0.351

Interest N.A.

General Management N.A.

Selling, Marketing N.A.

Unnamed
(8,000 gpm)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(32,000 gpm)

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8)

Year: 1971

State: N.A.

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8501

Type of Ore:
6 ppm U_3O_8 in copper leach solution after copper precipitation has taken place

Type of Mill: Ion exchange resin and solvent extraction ①

Yards or Tons per Day or Shift: 32,000 gpm

Products: U_3O_8

No. of Employees: 6/shift

Operators Wages: $3.25/hr.

Source of Power: N.A.

Type of Crushing & Grinding: leach solution after copper precipitation

Distance to Smelter: N.A.

% Recovery: 90%

How Shipped: N.A.

Water Source: N.A.

Indirect Costs per ton:	$0.174/lb U_3O_8
Direct Costs per ton:	$0.869/lb U_3O_8
Fixed Costs per ton:	$0.409/lb U_3O_8
Capitalization Costs per ton:	N.A.
Rehabilitation Costs per ton:	N.A.
Total Milling costs per ton:	$1.452/lb U_3O_8
Shipping costs per ton:	N.A

Method of Tailings Disposal: N.A.

Method of Rehabilitation of Tailings: N.A

Remarks:
Cost analysis of recovering U_3O_8 from copper leach solution

over ↓

Unnamed
(32,000 gpm

Indirect Costs

Labor, Management, Supervision, Clerical - $0.023/lb

Mine Office, Warehouse - $0.109/lb (Administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.042/lb

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A.

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor - $0.125/lb

Maintenance Labor - $0.020/lb

Operating Supplies, Powder, Steel - $0.611/lb

Utilities - $0.113/lb

Transportation Mine to Mill N.A.

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.113/lb (taxes and insurance)

Depreciation - $0.296/lb

Interest N.A

General Management N.A.

Selling, Marketing N.A.

Unnamed
(32,000 gpm)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Chatt. Shale

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8)
Year: 1969

State: Tennessee

District or County: N.A

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8501

Type of Ore:
30-35% quartz, 30-35% clay, 20% organic matter, 10% pyrite. Chattanooga Shale

Type of Mill: Countercurrent

Products: U_3O_8

Yards or Tons per Day or Shift:
1,980 lbs U_3O_8/day

Operators Wages: \$3.00-\$3.25/hr.

No. of Employees:
23/shift

Type of Crushing & Grinding: ①

Source of Power: N.A

% Recovery: 70%

Distance to Smelter: N.A

Water Source: N.A.

How Shipped: N.A

Indirect Costs per ton: . . . . \$1.287/lb U_3O_8

Direct Costs per ton: . . . . \$29.276/lb U_3O_8

Fixed Costs per ton: . . . . \$6.970/lb U_3O_8

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: . . . . \$37.533/lb U_3O_8

Shipping costs per ton: . . . . N.A

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A.

Remarks:
Cost analysis of recovering U_3O_8 from Chattanooga Shale.

over↓

① jaw crusher (-8" set)
↓
gyratory crusher (-4" set)
↓
hydrocone crusher (-1" set)
↓
rod mill (-35 mesh

Chatt. Shale

Indirect Costs

Labor, Management, Supervision, Clerical – $0.200/lb

Mine Office, Warehouse – $0.726/lb (Administration and general overhead)

Payroll Overhead - Social Security, Insurance – $0.361/lb

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor – $0.989/lb.

Maintenance Labor – $0.257/lb

Operating Supplies, Powder, Steel – $26.74/lb

Utilities – $1.29/lb

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $1.923/lb (taxes and insurance)

Depreciation – $5.047/lb

Interest N.A

General Management N.A

Selling, Marketing N.A

Chatt. Shale

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Unnamed
(leached zone)

MILLING COST DATA

Minerals or Ore: Uranium (U_3O_8)

Year: 1969

State: Florida

District or County: N.A.

Mineral Supply Study

Mill: Unnamed

Owner or Operator: N.A.

Source of Information: IC 8501

Type of Ore: The leached zone above the Florida phosphate deposits

Type of Mill: Solvent extraction

Yards or Tons per Day or Shift: 1072.7 lbs U_3O_8/day produced

No. of Employees: 15/shift

Source of Power: N.A

Distance to Smelter: N.A

How Shipped: N.A

Products: U_3O_8

Operators Wages: \$3.20/hr

Type of Crushing & Grinding: N.A

% Recovery: N.A.

Water Source: N.A

Indirect Costs per ton: \$3.19

Direct Costs per ton: \$40.65

Fixed Costs per ton: . . . . \$ 8.80

Capitalization Costs per ton: . . . . N.A.

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: \$52.64

Shipping costs per ton: . . . . N.A.

Method of Tailings Disposal: N.A

Method of Rehabilitation of Tailings: N.A.

Remarks:
Estimated operating costs, leached zone uranium recovery.

Unnamed
(leached zone)

Indirect Costs

Labor, Management, Supervision, Clerical — $0.46/lb

Mine Office, Warehouse - $1.94/lb (administration and general overhead)

Payroll Overhead - Social Security, Insurance - $0.79/lb

Union Welfare, etc. N.A.

Medical and Life Insurance N.A.

Royalties N.A.

Pension Funds N.A.

Severance Tax N.A.

Rehabilitation Costs N.A.

Direct Operating Costs

Production Labor - $1.50/lb

Maintenance Labor - $1.19/lb

Operating Supplies, Powder, Steel - $31.94/lb

Utilities — $6.02/lb

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A.

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $2.43/lb (taxes and insurance)

Depreciation - $6.37

Interest N.A.

General Management N.A.

Selling, Marketing N.A

Unnamed
(leached zone)

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

ZINC

MILLING COST DATA

Year: 1946

Minerals or Ore: Lead, Zinc

State: Idaho

District or County: Shoshone County, Yreka mining district

Mill: Little Pittsburg Mill

Owner or Operator: Denver Development Co.

Source of Information: IC 7429

Type of Ore:
A fine-grained mixture of sphalerite, galena, pyrite, and pyrrhotite in a gangue of silicified argillite and quartz

Type of Mill: Flotation

Yards or Tons per Day or Shift:
150 tons/day

No. of Employees: N.A

Source of Power:
Washington Water Power Co

Distance to Smelter:
5 miles

How Shipped:
Truck

Products: Zinc, Lead Concentrates

Operators Wages:
$9.73/shift

Type of Crushing & Grinding: ①

% Recovery:
Lead-90.7%, Zinc-92.0%

Water Source:
mine, Denver Creek, Trapper creek

Indirect Costs per ton: $1.5735

Direct Costs per ton: $2.3635

Fixed Costs per ton: $0.3056

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A.

Total Milling costs per ton: $4.2426

Shipping costs per ton: $1.25

Method of Tailings Disposal: Tailings pond

Method of Rehabilitation of Tailings: N A

Remarks:

over ↓

9" x 15" jaw crusher
↓
No. 22 Fahrenwald Swing-Head Cone Crusher (24")
↓
8' x 36" Ball Mill

Indirect Costs

Labor, Management, Supervision, Clerical - $1.2004

Mine Office, Warehouse N.A

Payroll Overhead - Social Security, Insurance N.A

Union Welfare, etc. N.A

Medical and Life Insurance N.A

Royalties N.A

Pension Funds N.A

Severance Tax N.A

Rehabilitation Costs N.A.
miscellaneous - $0.3731

Direct Operating Costs

Production Labor
Maintenance Labor } $0.7806 (labor)

Operating Supplies, Powder, Steel $0.982

Utilities - $0.3007

Transportation Mine to Mill N.A

Freight, Supplies Delivered - $0.1950 (concentrate & supplies)

Future Development Costs, N.A

Maintenance and Service of Equipment N.A
transportation of men $0.1052

Fixed Costs

Property Taxes
Other Fixed Taxes (Severance) } $0.3056 (taxes)

Depreciation N.A

Interest N.A

General Management N.A

Selling, Marketing N.A

Capital Costs N.A.

Working Capital

Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

Capitalization of Equipment

Capitalization of Plant

Tennessee-Schuylk

MILLING COST DATA

Minerals or Ore: Lead, Zinc
Year: 1938

State: Arizona

District or County: Wallapai mining district

Mill: Tennessee-Schuylkill Mine and Mill

Owner or Operator: Tennessee-Schuylkill Corp.

Source of Information: IC7077

Type of Ore:
Galena [illegible], gold bearing pyrite, and sphalerite in a gangue consisting chiefly of quartz and soft, ①

Type of Mill: Selective Flotation

Products: Lead Concentrate, Zinc Concent

Yards or Tons per Day or Shift:
150 tons/day

Operators Wages: $4.00-$5.00/shif

No. of Employees: 12

Type of Crushing & Grinding: ②

Source of Power:
Citizen's Utility Co., Kingman Ariz.

% Recovery:
Pb-97.7%, Zn-88.5%, Au-95.9%, Ag-94.

Distance to Smelter:
③

Water Source:
Tailing pond, mine

How Shipped:
N.A.

Indirect Costs per ton: $0.2526

Direct Costs per ton: $1.0944

Fixed Costs per ton: . . . . N.A

Capitalization Costs per ton: . . . . N.A

Rehabilitation Costs per ton: . . . . N.A

Total Milling costs per ton: $1.387

Shipping costs per ton: . . . . $6.65- $11.50 ④

Method of Tailings Disposal: Tailing pond

Method of Rehabilitation of Tailings: N.A

Remarks:

over ↓

① altered fragments of wall rock. The ore also contains small amounts of crystalline pyrite and arsenopyrite. The ore shoots generally rake northward above the 900-ft level and tend to change to nearly vertical between the 900 and 1,400 foot levels.

② 10" x 20" Allis Chalmers jaw crusher set at ¾"
↓
6' x 4½' Marcy ball mill (3" dia forged steel balls)

③ Distance to smelter for lead concentrate is approximately 400 miles (El Paso, Texas)
Distance to smelter for zinc concentrate is approximately 600 miles (Amarillo, Texas)

④

Concentrates:	Lead	Zinc	Jig
To Kingman, Az.	$1.50	$1.50	$1.50
to smelter	$5.50 (El Paso, Tx)	$5.15 (Amarillo, Tx)	$10.00
shipping charge/ton.	$7.00	$6.65	$11.50

Tennessee - Schuylkill

Indirect Costs

Labor, Management, Supervision, Clerical - $0.1105

Mine Office, Warehouse - $0.1329 (miscellaneous and office expense)

Payroll Overhead - Social Security, Insurance - $0.0218 (unemployment tax a
old age benefit tax)

Union Welfare, etc. N.A

Medical and Life Insurance - $0.0174

Royalties - $0.0100

Pension Funds N.A

Severance Tax N.A.

Rehabilitation Costs N.A

Direct Operating Costs

Production Labor -- $0.2746

Maintenance Labor - $0.0740

Operating Supplies, Powder, Steel - $0.3830

Utilities - $0.3628

Transportation Mine to Mill N.A

Freight, Supplies Delivered N.A

Future Development Costs N.A.

Maintenance and Service of Equipment N.A

Fixed Costs N.A.

Property Taxes

Other Fixed Taxes (Severance)

Depreciation

Interest

General Management

Selling, Marketing

Tennessee - Schuylkill

Capital Costs N/A

Working Capital

— Purchase Cost

Capitalization of Exploration and Development

Roads and other local construction

— Capitalization of Equipment

Capitalization of Plant